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NEW JERSEY MEDICAL SCHOOL
University of Medicine & Dentistry of New Jersey

KESSLER FOUNDATION RESEARCH CENTER

Department of Physical Medicine and Rehabilitation

University of Medicine and Dentistry of New Jersey
New Jersey Medical School

The Twentieth Annual
Resident, Fellow & Postdoctoral Fellow
Research Symposium
Abstract Book
Wednesday, June 10, 2009
12:30 PM — 5:15 PM

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1199 Pleasant Valley Way, West Orange, New Jersey 07052

University of Medicine & Dentistry of New Jersey - New Jersey Medical School
Department of Physical Medicine & Rehabilitation

2009

GRADUATING RESIDENTS

Steve M. Aydin, DO
Gina M. Benaquista, DO
Jennifer I. Epperlein, DO
Maya C. Evans, MD
Jonathan S. Kirschner, MD
Chiawen Lucy Liang, MD
Arik Mizrachi, MD
Joshua B. Reimer, MD
Michael Rhee, MD
Elizabeth A. Varghese-Kroll, MD

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Stacey Franz, DO
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Priti Vohra, DO

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THE OATH OF HIPPOCRATES

I do solemnly swear by that which I hold most sacred:

That I will be loyal to the profession of medicine and just and generous to its members.

That I will lead my life and practice my art in uprightness and honor.

That into whatsoever house I shall enter, it shall be for the good of the sick, holding myself aloof from wrong, from corruption, and from the tempting of others to vice.

That I will exercise my art solely for the care of my patients and will give no drug and perform no operation for a criminal purpose, far less suggest it.

That whatsoever I shall see or hear of the lives of people which is not fitting to be spoken, I will keep inviolably secret.

These things I do promise and in proportion as I am faithful to this my oath, may happiness and good repute be ever mine and the opposite if I shall be forsworn.

THE OSTEOPATHIC OATH

I do hereby affirm my loyalty to the profession I am about to enter.

I will be mindful always of my great responsibility to preserve the health and the life of my patients, to retain their confidence and respect both as a physician and a friend who will guard their secrets with scrupulous honor and fidelity, to perform faithfully my professional duties, to employ only those recognized methods of treatment consistent with good judgement and with my skill and ability, keeping in mind always nature's laws and the body's inherent capacity for recovery.

I will be ever vigilant in aiding in the general welfare of the community, sustaining its laws and institutions, not engaging in those practices which will in any way bring shame or discredit upon myself or my profession.

I will give no drugs for deadly purposes to any person, though it be asked of me.

I will endeavor to work in accord with my colleagues in a spirit of progressive cooperation, and never by word or by act cast imputations upon them or their rightful practices.

I will look with respect and esteem upon all those who have taught me my art. To my college I will be loyal and strive always for its best interests and for the interests of the students who will come after me. I will be ever alert to further the application of basic biologic truths to the healing arts and to develop the principles of osteopathy which were first enunciated by Andrew Taylor Still.

OATH FOR SCIENTISTS

As I embark on my career as a biomedical scientist,

I willingly pledge that
I will represent my scientific profession honorably, that I will conduct my research and my professional life in a manner that is always above reproach, and that I will seek to incorporate the body of ethics and moral principles that constitute scientific integrity into all that I do.

I will strive always
to ensure that the results of my research and other scientific activities ultimately benefit humanity and that they cause no harm.

With this affirmation
I pledge to acknowledge and honor the contributions of scientists who have preceded me, to seek truth and the advancement of knowledge in all my work, and to become a worthy role model deserving of respect by those who follow me.

UMDNJ
University of Medicine & Dentistry of New Jersey

Department of Physical Medicine and Rehabilitation
National Teaching Award Recipients

Year	Recipient	Affiliation
1988	Justus F. Lehmann, M.D.	University of Washington
1989	Frederic J. Kottke, M.D., Ph.D.	University of Minnesota
1990	Gerald J. Herbison, M.D.	Thomas Jefferson University
1991	Rene Cailliet, M.D.	University of Southern California
1992	Barbara J. deLateur, M.D., M.S.	Johns Hopkins University
1993	George H. Kraft, M.D.	University of Washington
1994	Ernest W. Johnson, M.D.	Ohio State University
1995	Mehrsheed Sinaki, M.D.	Mayo Clinic
1996	Diana D. Cardenas, M.D.	University of Washington
1997	Stanley A. Herring, M.D.	University of Washington
1998	Daniel Dumitru, M.D.	University of Texas-San Antonio
1999	James A. Sliwa, D.O.	Rehabilitation Institute of Chicago/ Northwestern University
2000	Andrew J. Haig, M.D.	University of Michigan
2001	Lawrence R. Robinson, M.D.	University of Washington
2002	Kristjan T. Ragnarsson, M.D.	Mount Sinai School of Medicine of New York University
2003	Elliot J. Roth, M.D.	Northwestern University

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University of Medicine & Dentistry of New Jersey

Department of Physical Medicine and Rehabilitation

National Teaching Award Recipients

Year	Recipient	Affiliation
2004	Ross Zafonte, D.O.	University of Pittsburgh School of Medicine
2005	Teresa L. Massagli, M.D.	University of Washington
2006	William F. Micheo, M.D.	University of Puerto Rico School of Medicine
2007	Jacqueline J. Wertsch, M.D.	Medical College of Wisconsin
2008	John Whyte, M.D., Ph.D.	Moss Rehabilitation Research Institute
2009	Steven R. Flanagan, M.D.	New York University School of Medicine

The Department of Physical Medicine and Rehabilitation of the UMDNJ-New Jersey Medical School & Kessler Foundation

Proudly presents

SELECTED TOPICS IN PHYSICAL MEDICINE AND REHABILITATION

With

Guest speaker & recipient of the 2009
UMDNJ-New Jersey Medical School National Teaching Award

Steven Flanagan, M.D.

Professor and Chairman of Rehabilitation Medicine
New York University School of Medicine
Medical Director, Rusk Institute of Rehabilitation Research Medicine
NYU – Langone Medical Center

June 9, 2009 - 4:30 p.m. – 6:30 p.m.
Traumatic Brain Injury Review
(Residents only no CME awarded)

June 10, 2009 - 9:30 a.m. – 11:30 a.m.
Aging with Traumatic Brain Injury: Changes in Mortality and Long-term Health Problems
&
TBI: Emerging Prospects for Assessments and Treatments

Kessler Foundation designates this program for 2.0 credit hours in Category 1 of the Physician's Recognition Award of the American Medical Association. Physicians should only claim credit commensurate with the extent of their participation in this activity. Kessler Foundation is accredited by ACCME to sponsor continuing medical education programs for physicians.

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This activity is sponsored by Kessler Foundation and The Baird Fund

Steven Flanagan, M.D.

Dr. Steven Flanagan is Professor and Chairman of the Department of Rehabilitation Medicine, New York University School of Medicine, and the Medical Director of the Rusk Institute of Rehabilitation Medicine, New York University Langone Medical Center.

He was formerly the Vice Chair of the Department of Rehabilitation Medicine, Mount Sinai School of Medicine and the Medical Director of the Brain Injury Rehabilitation Program.

He received his Bachelor of Science from Fairfield University in 1984 and his Medical Degree from University of Medicine and Dentistry of New Jersey in 1988. He completed his residency training in Physical Medicine and Rehabilitation, Mount Sinai School of Medicine in 1992, where he served as Chief Resident during his last year of training. He joined the faculty of the Department of Rehabilitation Medicine at Mount Sinai School of Medicine in1992 and remained there till April 2008.

He has served on medical advisory boards of many national and international committees, including the Brain Trauma Foundation and the Indian Head Injury Foundation. He is the Chairman of the Brain Injury Special Interest Group of the American Academy of Physical Medicine and Rehabilitation, and served as an Examiner for the American Board of Physical Medicine and Rehabilitation. He also serves as a peer reviewer for the American Journal of Physical Medicine and Rehabilitation Medicine and the Archives of Physical Medicine and Rehabilitation.

Dr. Flanagan has presented at scientific meetings both nationally and internationally, most notably on topics pertaining to brain injury rehabilitation. He has authored numerous chapters and publications and has participated in both federally and industry sponsored research, funded by such organizations as the National Institute on Disability and Rehabilitation Research and the National Institute on Aging.

Residents 2009

(left to right) Jonathan S. Kirschner, MD; Michael Rhee, MD; Chiawen Lucy Liang, MD;
Jennifer I. Epperlein, DO; Gina M. Benaquista, DO; Maya C. Evans, MD;
Elizabeth A. Varghese-Kroll, MD; Steve M. Aydin, DO;
Arik Mizrachi, MD, Joshua B. Reimer, MD; Ronald Karnaugh, MD

Clinical Fellows 2009

Jessica Bloomgarden, MD and Omar Gomez-Medina, MD

Stacey Franz, DO and Priti Vohra, DO

Postdoctoral Fellows 2009

Peii Chen, PhD and James F. Sumowski, PhD

UMDNJ-New Jersey Medical School

Department of
Physical Medicine and Rehabilitation

Abstracts Digest

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PART I

RESIDENT, FELLOW & POSTDOCTORAL FELLOW

PRESENTATION ABSTRACTS

UMDNJ - New Jersey Medical School
Department of Physical Medicine & Rehabilitation

RESEARCH ABSTRACTS
Part I

The Role of Radiofrequency Ablation for Sacroiliac Joint Pain; a Literature Review and Meta-Analysis

Steve M. Aydin, DO
Todd P. Stitik, MD, Michael Brimacombe, PhD

Introduction: The sacroiliac (SI) joint can often be the culprit of low back pain, and at least 15% of low back pain is due to SI joint pathology. The joint is believed to be innervated by the ventral rami of L4 and L5, the superior gluteal nerve, and the dorsal rami of L5, S1 to S2, however, no absolute innervation pattern is known. Many times provocative testing can be helpful to make a diagnosis of sacroiliac pathology, along with fluoroscopic guidance for nerve blocks to confirming the diagnosis of SI joint pain. Treatment for SIJ pain can range from conservative to surgical. More recently, radiofrequency ablation (RF-A) has become an option for those with chronic refractory pain. The purpose of this study is to review the literature, and conduct a meta-analysis to assess the effectiveness of RF-A of the SI joint pain at 3 and 6 months post procedure.

Design: An electronic search of Pub Med, OVID, Medline, and CINAHL were conducted. Articles that addressed RF-A of SI joint pain and/or syndrome were reviewed. A total of 9 articles ranging from inception to April 1st, 2009 were found. The data from each article was collected, and analyzed. The main outcome measure was a reduction of pain by 50% or greater as indicated in the each study.

Methods: A meta-analysis with a forest plot was done at the 3 and 6 months patient follow ups. The data was collected, and the associated standard error was calculated for each study group that met criteria. An overall weighted average with respective standard error was also obtained. A calculation of 95% confidence intervals (95% CI) was then derived. At 3 months 8 groups met criteria (from 7 studies), and at 6 months 5 groups met criteria (from 4 studies). A test for heterogeneity was also done at both the 3 and 6 month intervals.

Results: At 3 months a 95% confidence interval of 0.529 – 0.674 was found, with a pooled mean of 0.601. At 6 months a 95% CI of 0.377 – 0.587 was found, with a pooled mean of 0.482. There was little evidence of heterogeneity, p-value=0.927, in the 3 month study. At 6 months there was less evidence of homogeneity, p-value=0.193.

Conclusion: The meta-analysis study did demonstrate that RF-A was an effective treatment for SI joint pain at the 3 month interval. At the 6 month interval, there was less evidence to support consistent pain reduction with RF-A. Limited data is available for 9 and 12 month follow ups. Further standardization of RF-A lesion techniques of the SI joint needs to be established, coupled with randomized-controlled trials of this procedure.

Osteopathic Manipulative Treatment for Headache After Traumatic Brain Injury: A Randomized Controlled Pilot Study

Gina M. Benaquista, DO
Peter P. Yonclas, MD, Susan V. Garstang, MD

Introduction: The incidence of traumatic brain injury (TBI) is an estimated 1.4 million per year and continues to rise as a result of the Iraq War. Headache is recognized as the most frequent cause of chronic pain in patients with TBI. Chronic post-traumatic headache (PTH) begins within seven days of TBI (or after regaining consciousness) and persists for greater than three months. The pathophysiology of PTH remains poorly understood and is often multi-factorial in nature, making treatment of this condition difficult. Current treatments tend to be based on guidelines for primary (non-traumatic) headaches, however, these paradigms have not been well studied for post-traumatic headaches. Many case reports have described successful reduction and/or elimination of chronic PTH with osteopathic manipulative treatment (OMT). However, there have not been any randomized controlled studies on the treatment effects of OMT on chronic PTH. Osteopathic manipulative treatment is an established, well-tolerated manually-applied therapy that can be directed at any body region with somatic restriction to improve tissue motion and thereby flow of lymphatic and blood products. The purpose of this single-blind randomized controlled pilot study is to evaluate the treatment effects of OMT on chronic PTH. It is hypothesized that one session of OMT will decrease the intensity of post-traumatic both immediately after treatment and at one-week post-treatment.

Design: Male and female adult subjects with history of chronic PTH were randomized into two groups and blinded to their assignment. The treatment group received one thirty-minute OMT session. The treatment was individualized and targeted at somatic dysfunctions throughout the body identified on preceding osteopathic structural examination. Subjects in the control group received comparable structural evaluation and thirty-minute sham treatment by the same investigator. Headache intensity was assessed immediately before and after treatment and one-week post-treatment using a 100mm visual analog scale anchored at “no headache” and “unbearable headache”. Subjective relief of headache was also assessed one-week post-treatment using a five-point scale anchored at “much worse” and “much better”. Changes in pre- and post-treatment headache frequency, associated symptoms, and usage of medication were noted.

Findings/Conclusion: So far, 8 patients have been enrolled. The results and conclusion of the study are pending completion of data collection and analysis.

Agreement in Neurological Classification of Spinal Cord Injuries

Jessica Bloomgarden, MD
Steven Kirshblum, MD

Introduction: The *International Standards for Classification of Spinal Cord Injury* (the *Standards*), developed by the American Spinal Injury Association (ASIA), are widely used for assessing and classifying patients with spinal cord injury (SCI) in both research and clinical settings. Previous studies on reliability of classification using the *Standards* are limited and demonstrated areas of confusion. Past versions were revised to improve reliability of classification. Despite the previous clarifications, confusion remains in the classification of cases that are not straightforward. The purpose of this study is to identify some of the more challenging aspect of the classification schema.

Methods: Six cases were reviewed by a panel of professionals in SCI, including board certified physiatrists in SCI, an orthopedic surgeon board certified in SCI, and a physical therapist. For each case the area of confusion was noted and discussed.

Findings: An area of confusion was the use of the neurological level for determination of grade C versus D, but the use of motor level for grade B versus C. Another difficulty differentiating between grades C and D occurred where exactly half of the muscles below the neurological level were 3/5 or greater, and half were less than 3/5. This scenario should be scored as an ASIA D. In the transition between grades B and C, there was confusion when voluntary contraction was present in non-key muscles. The presence of voluntary contraction of any muscle more than 3 segments below the motor level indicates an AIS grade C. The transition zones where no muscle is available to test, namely C2-C4 and T2-L1, also challenged our raters. The presence of sensory sparing in transition zones should not imply that motor sparing is also present. Where the Standards are not clear is the situation in which the sensory level is in a transition zone, but the motor level appears to be lower based on preserved strength in key muscles below the sensory level.

Conclusions: The current version of the Standards has good agreement in classification except for unusual patterns of deficits. We recommend further clarifications to the Standards and Reference Manual, with standardized training and testing for clinical purposes and particularly in clinical trials to improve accuracy of the assessment of ASIA Impairment Scale. Trained examiners using a consistent approach to classification should achieve high levels of agreement. For clinical trials, inclusion/exclusion criteria can be used to eliminate unusual cases that may bias results.

Visuospatial Training for Stroke Survivors with Right Hemisphere Damage

Peii Chen, PhD

John DeLuca, PhD, Kerline Lorantin,BS, Anna M. Barrett, MD

Introduction: After a right hemisphere stroke, visuospatial deficits may occur, impairing survivors in encoding and retrieving information in a global-to-local fashion, even with intact visual sensory function. This study examined effectiveness of a visuospatial training based on a framework-to-detail encoding strategy in right hemisphere stroke survivors with visuospatial deficits. The goal was to improve visuospatial memory.

Participants: Six post-stroke participants (3 males; mean age = 70.2 ± 8.7 years) with right hemisphere brain damage finished the study. The time between onset of stroke and testing was 14.4 ± 16.5 weeks. Without reaching the criteria for diagnosis of spatial neglect, all the participants had visuospatial impairment.

Methods: The Rey-Osterrieth Complex Figure test was used as the testing and training material. Participants copied, immediately drew the figure from memory, went through the 5 steps of the framework-to-detail training, and drew the figure again after a 30-minute delay. Each drawing was scored in terms of accuracy and organization by two raters.

Findings: After training, participants' immediate recall performance improved almost 200% in accuracy (from 7.0 to 13.4) with a very large effect size (d = 1.46), and participants were able to accurately retain the information for 30 minutes. Organization measures showed a similar pattern in that performance improved, also with very large effect sizes (d = 3.47 and 1.97, respectively on perceptual cluster score and perceptual cluster ratio). This benefit was also maintained for a 30-minute delay.

Conclusion: The provided framework-to-detail encoding strategy improved recall, suggesting that right hemisphere stroke survivors, although impaired in global-to-local processing, may learn to use the framework-to-detail strategy to encode and retrieve abstract complex information. Further investigation will focus on applications to activities of daily living.

Assessment of Alterations in the Pulmonary Function of Spinal Cord Injured Patients After Osteopathic Manipulative Treatment versus Sham Treatment

Jennifer Epperlein, DO
Steven Kirshblum, MD

Introduction: Respiratory complications are a well known cause of morbidity and mortality in the spinal cord injured population. Many factors contribute to this including respiratory muscle weakness, prolonged use of ventilator support, immobility, and a decrease in thoracic compliance. Treatments directed at improving any one of these factors may have the potential to improve pulmonary function in this population. Osteopathic manipulation is a well established, well tolerated manually-applied therapy that can be directed at any body region with somatic restrictions, to improve tissue motion and compliance. The use of osteopathic manipulative treatments (OMT) directed at the thorax of spinal cord injured patients may improve their pulmonary function. The effect that OMT has on pulmonary function has been studied in patients with asthma and COPD. A review of the literature revealed no studies investigating the use of osteopathic manipulation in spinal cord injured patients. It is the objective of this study to determine if osteopathic manipulation applied to the thorax of spinal cord injured patients can immediately improve their vital capacity and peak cough flow measurements more than a sham treatment.

Design: This is a randomized, single-blinded, cross-over pilot study.

Methods: Participants were recruited from the inpatient acute rehabilitation unit of the Kessler Institute for Rehabilitation in West Orange, NJ and seen for 3 visits each. Inclusion criteria included spinal cord injured men and women with neurologic level of injury C4-T9, ASIA A or B, with the ability to breathe off the ventilator for 2 hours. Participants were excluded for recent thoracic surgery, stabilization with a halo/vest, or those receiving treatment for current pulmonary exacerbations (pneumonia, asthma, COPD). Visit one involved two sets of baseline measurements of the vital capacity and peak cough flows, done 1 hour apart by a respiratory therapist with established intra-rater reliability. Participants were then randomized to receive either osteopathic manipulative treatment or a sham treatment first, and crossed-over 1 week after initial treatment to receive the other. The active treatment consisted of multiple osteopathic techniques including myofascial release, rib raising, and balanced ligamentous technique applied to the thoracic cage. The sham treatment consisted of superficial pressure applied to the thoracic cage. The participants and respiratory therapists recording the pulmonary measures remained blinded to which treatment was active and sham. The vital capacity and peak cough flow was measured pre and post-treatment on visits 2 and 3. At the study's conclusion, the patients and respiratory therapists completed questionnaires about the treatments.

Findings/Conclusions: Pending completion of data collection.

The Prevalence and Effect of Obesity on Rehabilitation after Spinal Cord Injury: A Retrospective Chart Review

Maya Evans, MD
Trevor Dyson-Hudson, MD, Amanda Botticello, PhD, MPH

Introduction: The majority of Americans are overweight or obese. Obesity been described as an American epidemic and one of the greatest burdens to healthcare. It is well known that obesity negatively affects many areas of health but its effect on acute rehabilitation has only begun to be studied. It stands to reason that obese individuals face a different set of challenges than their non-obese counterparts, and this is likely magnified by the intense physical demands of acute inpatient rehabilitation following spinal cord injury (SCI). The goal of this study is to first describe the prevalence of obesity among SCI patients at Kessler during the last year. Additionally differences in demographics and rehabilitation outcomes such as length of stay (LOS), Functional Independence Measure (FIM) efficiency, discharge location and type of bladder management will be examined between obese and non-obese patients with SCI.

Design: Retrospective chart review.

Methods: Data will be collected from an electronic chart review and data complied from SCI patients at Kessler during the last year via erehabdata.com. The review will include data from all patients with a diagnosis of a spinal cord injury admitted to Kessler West in the last year (N≈270) during the acute rehabilitation phase. Data on adult patients (i.e., between ages 18 and 100) will be used. The patients will be divided according to body mass index (BMI=weight in kg/height in meters^2). Descriptive data compared between the groups will be age at injury, gender, race/ethnicity, height, weight, length of time from injury to Kessler admission, martial status, highest level of education obtained, type of insurance, American Spinal Injury Association (ASIA) score, and cause of SCI. Rehabilitation outcomes will be assessed by comparing LOS, FIM efficiency type of bladder management at discharge, and discharge location between groups. Statistical analysis will be performed in SPSS (version 16.0). Standard univariate methods will be used to document the extent of obesity in the local patient population and to construct a weight group typology for purposes of comparisons. Bivariate analytic techniques will used to compare differences between all individual characteristics and rehabilitation outcomes by weight group. The need for multivariate analysis of the relationship between obesity and functioning outcomes will be assessed.

Findings: The results of this study are forthcoming.

Conclusions: The authors hypothesize that obese patients will represent a larger than expected percent of Kessler admissions. Additionally it is hypothesized that obese patients will be older at the time of injury, will be more likely to have a non-traumatic injury, and have will less independence in bladder management, lower FIM scores, FIM efficiencies, longer LOS, and a lower rate of discharge to home as compared to their non-obese counterparts.

Hiccups following Radiofrequency Ablation and Epidural Steroid Injections: a Case Series of a Rarely Reported Side Effect

Stacey Franz, DO, MSPT
Boqing Chen, MD, PhD, Todd Stitik, MD, Patrick Foye, MD

Introduction: Interventional spinal procedures are a possible treatment technique for individuals with pain refractory to conservative, non-interventional approaches. As with all invasive procedures, interventional spinal techniques have been associated with side effects. Although such side effects are generally rare, their occurrence can be quite alarming and concerning to patients. Furthermore, while some side effects may be transient and essentially benign, others can adversely impact one's quality of life.

Design: Retrospective review that investigated less common side effects associated with fluoroscopic-guided interventional spinal procedures.

Findings: Post-procedure hiccups were noted in three different patients, one patient who underwent lumbar radiofrequency ablation (RFA), one who received a cervical epidural steroid injection (ESI) and another who received a lumbar ESI. In each case, despite the distressing side effect, the hiccups resolved spontaneously without any specific treatment. The exact mechanism by which hiccups are induced in these patients remains unclear. The literature suggests a correlation with steroid administration, which would be a possible explanation in our patients, as steroids were injected after RFA for prophylaxis of post-procedure neuritis and also included as the therapeutic component of the ESIs.

Conclusions: Although there are documented cases of hiccups following thoracic and lumbosacral epidural steroid injections, these are the first reported cases, to our knowledge, of hiccups with lumbosacral radiofrequency ablation and cervical epidural steroid injections. The literature has demonstrated that in some patients, hiccups can cause severe distress and affect a patient's quality of life. Specifically, persistent hiccups can effect the way patients talk, sleep, eat and drink, and if unresolved, can lead to weight loss, exhaustion, anxiety and depression. Therefore, it is essential for physicians to be aware of this possible side effect, and appropriate treatments, and communicate the information to their patients. Such information would likely be reassuring to patients who may develop the complaint.

Association Between Neuroendocrine Abnormalities, Fatigue, and Sleep Disorders in a TBI Population

Omar Gomez-Medina, MD
Elie Elovic, MD

Introduction: Sleep abnormalities after a traumatic brain injury (TBI) are relatively common and may affect the course of recovery and prognosis in TBI survivors. They included excessive daytime somnolence, insomnia, sleep phase cycle disturbance, narcolepsy, and sleep apnea. Previous studies have shown a prevalence of post TBI sleep disorders between 46% - 80%. This is markedly higher from the prevalence in the general population, which is 14.7%. In spite of being a common phenomenon in these patients, few studies have looked at the etiology, diagnosis and management of these disturbances in TBI. Current treatments are based in recognizing and managing co-morbid medical conditions, assessment and treatment of associated psychiatric disorders, and awareness of other psychosocial stressors. Non-pharmacologic treatments also include diet and environmental modifications. If improvement is not noted with these guidelines, then pharmacological treatment is considered. The few studies available in the literature suggest a correlation between the severity of the injury and some of the measures of sleep disruption but not others, indicating a complex and multifactorial pathogenesis.

Neuroendocrine derangements after Traumatic Brain Injury (TBI) have received increasing recognition in recent years because of their potential contribution to morbidity, and possibly mortality, after trauma. Some articles in the literature suggest an association with injury severity, however other don't. Significant changes of the hypothalamo-pituitary axis have been documented in the acute phase of TBI, with as many as 80% of patients showing evidence of gonadotropin deficiency, 18% of growth hormone deficiency, 16% of corticotrophin deficiency and 40% of patients demonstrating vasopressin abnormalities leading to diabetes insipidus or the syndrome of inappropriate anti-diuresis. Chronically, most of the studies suggest the prevalence of these disorders is lower than in the acute stage. The Growth Hormone axis is affected 15%, followed by secondary hypoadrenalism (5%), hypogonadism (2%), hypothyroidism (2%) and diabetes insipidus (2%). The effects of these derangements have not been fully evaluated, and they may contribute to, or be associated with, other conditions seen in this population.

Recently, a trend was noted between neuroendocrine abnormalities, specifically Growth Hormone deficiency, and perceived fatigue in TBI patients, which is more prevalent in this subjects (37% – 98%) than in the general population (24%). The fatigue in turn may be secondary to sleep disorders. Furthermore, the symptoms observed in neuroendocrine derangements include sleep abnormalities and symptoms related to fatigue, such as physical tiredness, decreased energy, reduced motivation, boredom, and prolonged mental activity. This is the case for thyroid, growth hormone, gonadotropin, and corticotrophin deficiencies. The overlapping of symptoms may point out an common association between these conditions.

To our knowledge no study has attempted to assess a correlation between neuroendocrine abnormalities and sleep disorders in a TBI population.

The efficacy of ultrasound guidance compared to blind corticosteroid injection for the treatment of carpal tunnel syndrome

Jonathan Kirschner, MD
Rex Ma, MD

Introduction: Corticosteroid injections have been shown to be beneficial in reducing symptoms in patients with carpal tunnel syndrome (CTS), and have shown to be superior to placebo, oral corticosteroids, and therapeutic exercise. One study even shows similar efficacy to surgery at one year. Ultrasound is becoming a popular modality to guide therapeutic injections, but it is not known if the extra time and cost associated with this tool can improve patient outcomes. The hypothesis of this study is that ultrasound guided corticosteroid injections can improve symptoms greater and longer in patients with CTS than blind injections. Data on median nerve size was also gathered to determine correlations between electrodiagnostic parameters, patient symptoms, and type of injection performed.

Design: The study is a randomized, single-blind, prospective trial, approved by the Institutional Review Board of the Department of Veterans Affairs (VA), New Jersey Health Care System.

Methods: Subjects were recruited from VA Physiatry and Electrodiagnostic clinics. Patients with median nerve distal motor latency > 4.2 msec, distal sensory latency > 3.5 msec or median to ulnar difference > 0.4msec were included in the study. Exclusion criteria included allergy to lidocaine, methylprednisolone or ultrasound gel or history of CTS surgery. Subjects were randomly assigned to control and treatment groups using a coin flip. If a patient had bilateral symptoms each hand was treated as a separate subject. At week 0, 2, 4 and 8 they filled out the Global Symptom Score (GSS) and graded their discomfort, numbness and pain on a visual analogue scale (VAS) from 0-100. They were placed in the seated position and an ultrasound monitor with a protective glare screen placed next to them out of view. An ultrasound probe was then placed on the affected wrist(s) and the size of the nerve at the distal wrist crease was recorded by an independent examiner. The machine was then left on for the treatment group or turned off for the control group. The investigator (R.M.) then entered the room and performed an injection into the carpal tunnel of 0.50mL (20mg) methylprednisolone (Depomedrol) and 0.50ml of 1% lidocaine (Xylocaine) using a 25 Gauge 1.5" needle, with or without the ultrasound guidance.

Findings: Subjects were followed at 2,4, and 8 weeks to assess repeat VAS and GSS scores, as well as any side effects from the injection. Follow-up measurements of median nerve size were taken as well.

Conclusions: To be presented on research day.

Survival Outcomes of a Noninvasive Intermittent Positive Pressure Ventilation and Mechanical Assisted Coughing Protocol for Patients with Duchenne Muscular Dystrophy

Chiawen Lucy Liang, MD
John Bach, MD

Introduction: Duchenne Muscular Dystrophy (DMD) affects 1 in 3,500 newborn males, with an overall prevalence of 63 cases per million. DMD is caused by mutations in the DMD gene, which is located on the X chromosome. DMD gene codes for dystrophin which is an integral part of myofibril. Without dystrophin, muscles are susceptible to mechanical injury and will undergo repeated cycles of necrosis and regeneration. An estimated 55-90% of patients with DMD who do not use ventilator support die from pulmonary complication associated with respiratory muscle weakness between 16.2 - 19 years of age.

Objective: The purpose of this study is to measure survival outcomes of DMD patients using noninvasive intermittent positive pressure ventilation with and without mechanical assisted coughing.

Design: Retrospective chart review

Methods: We include all DMD patients that have been seen in the UMDNJ- NJMS MDA clinic from 1983 – January 2009. They range from age 18 – 47. Information are gathered from the MDA Clinic office records in regard to the type of ventilation used, history of respiratory complications and hospitalizations, age and cause of death. Phone calls are made to patients for whom specific data entry points are lacking.

Findings: 148 charts are reviewed. Analysis is not available at time of publication.

Conclusion: We hypothesize that the patients using noninvasive intermittent positive pressure ventilation along with mechanical assisted coughing have less respiratory complications and hospitalizations, longer lifespan, and less mortality. The benefit of this study is to provide DMD patients, their caretakers, and healthcare providers statistical information regarding optimal respiratory care.

Viscosupplementation: Onset of Time Relief

Arik Mizrachi, MD
Todd P. Stitik, MD, Thomas Findley, MD, PhD

Introduction: Viscosupplementation (a.k.a. biosupplementation) refers to the concept of synovial fluid replacement with intra-articular injections of hyaluronic acid into joints for the relief of pain associated with osteoarthritis. Currently Food and Drug Administration (FDA) approved as safe and American College of Rheumatology (ACR) recognized as effective. FDA (1997) approved viscosupplementation for the treatment of pain associated with knee O.A. in patients who have failed non-pharmacologic treatment as well as acetaminophen. The impetus for this project came out of the fact that there was little data on the onset of time relief. Although there have been publications regarding duration of effect, very little published data on the time course of response i.e. how quickly does a patient respond to treatment? A question often asked by patients. In addition there is limited published data on factors that might affect treatment response: Male vs. female, Age, Unilateral vs. bilateral knee OA, 3 vs. 5 injections, Multiple Cycles. The purpose of this study was to ascertain answers to the above questions.

Design: Retrospective chart review of knee osteoarthritis patients who received viscosupplementation during a 3-year period. Prior to each injection a VAS was filled out. The VAS represented a scale on which the patient drew a line to designate their level of pain (0= no pain, 100= severe pain). A triple VAS was used for 3 aspects of pain: minimal, usual, maximum. A categorical assessment was used which included very good, good, fair, poor, very poor. Clinically significant pain relief was defined as having more than 15% change compared with baseline pain. The VAS score was observed over 5 weeks and regression analysis was used to see if there was statistical and/or clinically significant pain relief over 5 weeks. In addition, when after injection was there at least a 15% change in pain relief compared with the baseline, revealing onset of pain relief.

Findings: The number of patients who received at least 1 cycle of viscosupplementation was ~150. The age range was 30 to 89. The final study population included: 96 patients, 19 male, 77 female, 41 unilateral and 55 bilateral. For all 3 pain types, pain improved from baseline to week 5. Some differences in how quickly pain improved for Usual Pain, Least Pain, and Worst Pain as follows: 1.Usual Pain: Approximately 7.5 % drop in VAS score/week, therefore at week 3 (i.e. after 2 injections). 2. Least Pain: Approximately 10 % drop in VAS score/ week, therefore in between weeks 2-3 or roughly at the midpoint between injections 2 and 3. 3. Worst Pain: Approximately 5 % drop in VAS score per week, therefore at week 4 (i.e. after 3 injections).

Conclusions: All 3 pain categories: usual, least, & worst showed a statistically ($p = .001$) and clinically (i.e. > 15%) significant reduction from week 5 vs. baseline. All 3 categories showed at least 15% pain relief by the 3rd injection. There were no differences between males & females, unilateral and bilateral osteoarthritis, young and old.

.Injury Rates and Profiles Among Pediatric Rock Climbers: A Pilot Epidemiologic Study

Joshua Reimer, MD
JenFu Cheng, MD

Introduction: The last decade has signified a dramatic shift in the size composition of the climbing community, with the advent and rapid dissemination of indoor rock climbing gyms. This exposure has shifted the demographic of the climbing community, which now includes many children and teenagers. Similar to elite level gymnasts, these younger climbers now contribute to a significant percent of the top climbers in the world. Though they never trained with the frequency or intensity of today's elite level youths, older climbers of today have been shown to have significantly more evidence of osteoarthitic changes of the hand when compared to age matched controls. With the pervasiveness of overuse and repetitive strain injuries, there is concern that today's generation may be at risk for significant degenerative arthritis not only of the hands and fingers, but of the shoulders, wrists, and lower extremity. Despite the rapid growth in size of the pediatric rock climbing community, a prior literature review yielded included the conclusion that little research had been published on the rates and incidence of injuries amongst the younger athletes. Such data may help guide the formation of prevention strategies to avoid significant injury, functional impairment, and eventual disability.

Design: Cross-sectional/observational design. Pilot study. An IRB-approved survey was generated and distributed to parents at climbing gyms and regional competitions. Completed surveys describing specific factors related to the baseline demographics of each climber, as well as conditions specific to the individual injuries were analyzed. We collected ninety-seven distinct profiles of pediatric climbers, yielding forty-nine unique injury events.

Findings: A high preponderance was noted of finger and ankle injuries. Pearson chi-squared analysis to assess for significance of association of multiple variables revealed significant association between male gender and finger injury (p-value 0.001), and female gender and ankle injury (p-value 0.04). Binary logistic regression was used to demonstrate that male gender is predictive of finger injury (p-value 0.002 with 64.9 concordance) and that female gender is predictive of ankle injury (p-value 0.04 with concordance of 59.6). No significant association was found between climbing-type and finger or ankle injury.

Conclusion: Given the risks unique to each gender, there appears to be a role for proprioceptive training as a means of ankle injury prevention in female athletes. Education regarding technique in various grip techniques, consideration of prophylactic finger taping, and strategies for management of recurrent finger injury may be indicated in males. These results may herald the need for a change in coaching strategy, exercising more caution in encouraging male athletes to continue to rapidly advance in technical difficulty despite insufficient tendon and connective tissue strength.

The Effect of Upper Extremity Spasticity Management on Gait Function in the Spastic Hemiplegic Patient

Michael Rhee, MD
Elie Elovic, MD, Gary Galang, MD, Karen Nolan, MD

Introduction: Acquired brain injury (ABI), including traumatic brain injury (TBI) and stroke (CVA), commonly results in spastic hemiplegia. This can cause significant functional impairment including affecting an individual's gait. Improvement in gait has been noted after treatment with Botulinum toxin type A (BTX-A) of lower limb spastic muscles; the literature, however, is sparse on BTX-A treatment of upper limb spastic muscles and its effect on gait. Therefore, this study was undertaken to objectively evaluate whether BTX-A treatment of upper limb spasticity improves gait function in spastic hemiplegic patients.

Design: Prospective cohort, controlled, non-randomized, non-blinded study

Methods: Treatment and control subjects, recruited based on specific criteria, had two evaluations. The initial assessment was followed by a follow-up session 4-6 weeks later. The treatment group received BTX-A to the spastic upper limb after the initial evaluation, and the control patient received no treatment. Each evaluation included a neurologic exam, including spasticity assessment using the Modified Ashworth Scale (MAS), 6 walking trials over the Gaitrite Walkway System (3 at self-selected comfortable speed and 3 at fastest generated speed), and a 6-minute walking test. The results from the initial and follow-up evaluations were then compared for the treatment and control subjects. Gait parameters measured included gait velocity as well as step and stride length and width.

Findings: The results of the study are not yet available.

Conclusion: It is hypothesized that this study will show an improvement in the measured gait parameters in the treatment group compared to the control group. It is anticipated that this will provide evidence supporting BTX-A treatment of upper extremity spasticity to improve gait function.

Functional Neuroimaging of Cognitive Reserve in Multiple Sclerosis: Implications for the Default Network

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Introduction: The "default mode network" consists of brain regions (posterior cingulate / precuneus and ventral anterior cingulate) that are active during rest and that show progressively less activation as cognitive demands increase. Cognitive Reserve (CR) refers to premorbid neural efficiency / capacity, estimated with educational attainment and premorbid intelligence. This study investigated whether higher CR among persons with Multiple Sclerosis (MS) was associated with greater cerebral efficiency as evidenced by maintenance of default mode network activation despite increasing task demands.

Participants & Methods: FMRI data were acquired from 12 women with Relapsing Remitting MS (age = 40.9 ± 8.3; disease duration = 8.1 ± 7.8 years) during the N-Back working memory task. A CR component score was derived from WASI Vocabulary raw scores and years of education. Separate 3D whole brain regressions were performed to identify the relationship between CR and percent signal change for each N-Back condition while controlling for age, disease duration, and multiple comparisons.

Findings: CR was positively associated with activation of the default mode network during the 0-Back ($p < .005$), 1-Back ($p < .01$), and 2-Back ($p < .01$). During the 2-Back, there were also negative associations between CR and activation of the left middle and superior frontal gyri and premotor cortex ($p < .025$).

Conclusions: Higher CR is associated with greater cerebral efficiency among persons with MS, characterized by maintenance of default mode network activation and less additional recruitment of frontal regions as task demands increased. This is also the first known evidence that CR moderates default mode network activation.

The Prevalence of Spasticity Among Patients with Traumatic Brain Injury Admitted to an Inpatient Rehabilitation Facility

Elizabeth Varghese-Kroll, MD
Elie P. Elovic, MD, Gary N. Galang, MD

Introducation: Over 230,000 people every year are hospitalized secondary to traumatic brain injury (TBI). In addition, the Centers for Disease Control and Prevention (CDC) estimate that there are 5.3 million people in America who have sequelae secondary to TBI. Motor dysfunction, and in particular spasticity, occurs frequently after TBI but no reliable quantifiable information exists regarding this, with the exception of unpublished data of questionable value from the TBI Model Systems that quotes a figure of 25%. Spasticity is a common secondary disorder that significantly impairs patients' level of functioning and independence, but the actual prevalence of spasticity after TBI is unknown. Determination of this figure is crucial for resource allocation determination and the direction of future research.

Design: This was a prospective study with consecutive enrollment. Over 200 people with TBI are admitted yearly to the Kessler Institute for Rehabilitation. This study evaluated each of these patients over the course of a year to identify the prevalence of spasticity and the functional limitations that result. Funding was provided by a $5,000 Science and Technology Award and Research Scholarship.

Methods: Consecutive admissions between March 1, 2008 and February 28, 2009 to the Kessler West Orange and Chester traumatic brain injury inpatient rehabilitation units were evaluated. The prevalence of spasticity among TBI patients and any associated findings were determined using the modified Ashworth scale, and functional limitations resulting from spasticity were reviewed. Pertinent aspects of the history and physical examination of each patient were recorded (eg. age, anoxic vs. non-anoxic injury, length of hospital stay, etc.) Based on this data, the prevalence of spasticity among TBI inpatients was calculated.

Findings: Our study found a 27.8% prevalence of spasticity among patients admitted with TBI. Further results based on demographic information are not yet available.

Conclusions: Our study found a 27.8% spasticity prevalence among our inpatient TBI population. Based on our 6-month data, we expect an age distribution showing spasticity to be more common among younger patients, which is most likely due to younger patients being susceptible to more severe injuries. Based on our 6-month data, we also expect our final data to show that the lower extremities were more frequently involved. These findings will illustrate that spasticity is common post-injury, affecting over a quarter of patients with TBI. Given its often severe impact on function and quality of life, spasticity warrants further research funding and investigation.

Coccydynia (Tailbone Pain) due to Seatbelt Buckle Trauma:
A study of incidence and associated radiologic abnormalities

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Introduction: Coccyx pain is often the result of trauma. A variety of different traumatic etiologies and mechanisms for coccydynia have been described, but prior publications have never before reported trauma specifically from sitting abruptly on a seatbelt buckle. The goal of this study was to assess the frequency of such coccyx injuries from seatbelt buckles, among a population of patients with coccyx pain, as well as to assess any radiologic abnormalities associated with such injuries.

Methods: I.R.B.-approved chart review of 250 patients with coccydynia.

Setting: An outpatient Coccyx Pain Service at a University-based PM&R musculoskeletal and pain management practice.

Findings: Review of 250 medical records of patients with coccydynia revealed that three patients (1.2%) had reported that their coccyx pain began after accidentally sitting abruptly upon a seatbelt buckle. These three patients included two males (ages 18 and 19 years) and one female (age 31). Both males reported severe coccydynia that began immediately at the time of the seatbelt buckle incident, while the female patient's coccydynia became more substantial over the following few weeks. By the time of initial evaluation to the PM&R Coccyx Pain Service, the coccyx pain had generally persisted for a duration of 1.5 years and 6-7 years (variable, but recently increasing for the most recent 2 years) in the males and 7 months in the female. Imaging studies revealed significant anterolisthesis of a coccygeal segment in both males, while the female did not have imaging studies due to subsequent pregnancy at the time of initial evaluation. Thus, 100% (both) of those who underwent imaging studies had radiologic abnormalities at their symptomatic site.

Discussion: Since the 1960's, all automobiles sold nationwide have seatbelts installed (initially just front seat lap-belts, but eventually shoulder straps and back seat restraints as well). Seat belt use is well known to decrease injuries and fatalities in automobile collisions. However, injuries related to the seat belts themselves are not commonly reported, and have never before been reported to cause injuries at the coccyx. Coccydynia can significantly impair a person's quality of life and decrease their functional tolerance for activities requiring sitting. It can often be chronic and life-altering. Coccydynia can be due to trauma, infection, ligamentous laxity, malignancy, or other causes. Our study shows that blunt force trauma by accidentally sitting abruptly on a seatbelt buckle can be a source of coccygeal injury, with coccyx pain lasting for months to years. We speculate that recessed buckles may be less likely to cause such injuries.

Conclusions: Although the safety benefits of using seatbelts cannot be overlooked, our study shows that sitting on seatbelt buckles can be a cause of coccydynia. This mechanism of injury is reported by 3 (1.2%) out of 250 patients with coccydynia at a specialized coccyx pain center.

PART II

R-1Research Review Abstracts

PART II
PGY-2 RESEARCH ABSTRACTS

Repetitive botulinum toxin type-A injections for the management of spasticity in children with cerebral palsy

Katherine Bentley, MD
JenFu Cheng, MD

Introduction: Botulinum toxin type-A is a frequently used intervention for the management of spasticity in children with cerebral palsy. It is effective for both upper and lower limb spasticity. The therapeutic effect of a botulinum toxin injection on muscle begins within a few days of the injection and lasts 3 to 4 months. Many studies have been published and reviewed describing the initial response to botulinum toxin type-A injections. When the effect of botulinum toxin on the muscles abates; patients receive subsequent injections. Many times children with cerebral palsy require multiple repetitive injections for spasticity management. Long-term safety of botulinum toxin type-A has been demonstrated in adults for multiple indications.

Methods: Literature focusing on the effectiveness, the complications and antibody formation in repetitive injections of botulinum toxin type-A for spasticity in children with cerebral palsy was reviewed.

Findings: All of the studies reviewed conclude that repetitive injections are safe for spasticity management in children. Effects of treatment can be quantified using measurements of spasticity, joint range of motion and functional outcomes. The literature reviewed consistently illustrated short term benefits of injections of botulinum toxin. There is some evidence for continued long-term functional improvements and prevention of contracture formation many months after the completion of a series of injections. However, there were studies reviewed that did not show long term effectiveness**.** There is a retrospective study evaluating children treated with multiple injections over the course of one year that demonstrates treatment intervals remain stable. Antibody formation may contribute to a decreased response to subsequent treatments in some patients.

Conclusion: Repeat injections of botulinum toxin type-A for management of spasticity in children with cerebral palsy is a safe treatment option that is effective for at least the duration of the medication response. There is some data to suggest a series of repeat injections may have long-term benefits. It is difficult to differentiate the functional benefits of interventions for spasticity in growing children who are developing motor skills. Additional future research and longer-term studies may help clinicians continue to educate parents regarding repetitive injections for spasticity. In addition, studies that attempt to quantify the utility of spasticity injections in reducing the number and frequency of orthopedic surgical intervention would be beneficial.

Virtual reality in stroke rehabilitation: a review

Jose Santiago Campos, MD
Uri Adler, MD

Introduction: Stroke has widely been described as the leading cause of disability among the adult population. It is frequently responsible for a wide variety of impairments including weakness, limited of range of motion, and poor coordination with movement. These deficiencies commonly limit the individual's ability to live independently and perform daily activities. With the number of stroke survivors growing exponentially, the emphasis on rehabilitating this population becomes increasingly valuable.

Methods: Recent literature has suggested that more intensive rehabilitation consisting of mass repetition and practice of certain activities provides substantial benefit, helping to modify neural organization. However, with the limited frequency and time available during traditional therapy schedules, virtual reality programs provide an interactive, entertaining modality for patients to acquire new motor skills. A literature review was conducted to assess the benefits of using VR based therapy for rehabilitation of upper and lower extremity strength and coordination.

Findings: The literature that is currently available shows an overall improvement in upper and lower extremity function in patients who trialed VR based rehabilitation post-stroke. In addition, this therapy seems to provide substantial retention in the functional gains being made, making the future of virtual reality rehabilitation increasingly intriguing.

Conclusions: Unfortunately, the amount of research available regarding VR based rehabilitation is generally limited and consists of small subject sizes. However, the future is promising regarding clinical outcomes and community gains being made in both upper and lower extremity programs with VR based rehabilitation.

Chronic Pelvic Pain secondary to Lumbar Spinal Pathology

Anupama Ganga, MD
Jeffrey Cole, MD

Introduction: Chronic pelvic pain is usually attributed to several organic and functional disorders of the structures in the pelvic cavity and pelvic floor. When structural or specific pelvic pathology for the pain symptoms are not explainable the symptoms get categorized as functional disorders with unclear etiologies.

Aim: To conduct a literature review of lumbar spinal pathology and its association with chronic pelvic pain

Methods: A literature review for the years upto March 2009 was performed using the MEDLINE database of the United States National Library of Medicine.

Findings: Two case series and a case report were identified describing lumbar pathology as a possible cause of chronic pelvic pain. However multiple animal model studies discussed neurogenically mediated process at the lumbosacral region as a pathophysiological mechanism for chronic pelvic pain. The mechanisms are explained by various mechanisms such as expansion of pain projection fibers and receptive field in the WDR spinal lamina, antidromic axonal reflex via dichotomizing afferent neurons, dorsal root reflex causing viscero-somatic convergence in the spinal cord or via a sympathetic reflex.

Conclusion: Many animal model studies describe chronic pelvic pain secondary to neurogenically mediated process at the lumbosacral region. Although human case reports have been described, these are very limited.

DVT Prophylaxis Following Spinal Tumor Surgery

Benjamin D. Levy, MD
Mylan Lam, MD

Introduction: Spinal tumors have a devastating impact on the morbidity and mortality of the patients they afflict. A serious complication of this collection of diseases is deep venous thrombosis (DVT) formation. There is little literature available to definitively determine whether to initiate pharmacologic prophylaxis after surgical resection of spinal tumors. The complication most often cited by surgeons that dissuades them from employing pharmacologic DVT prophylaxis is the development of spinal epidural hematoma (SEH). We aim to provide a review of the available literature to determine the risk of DVT in spinal tumor patients and the risk of epidural hematoma in spinal surgery patients. Finally, we seek the best choice of DVT prophylaxis in this population.

Methods: A literature review was performed, and articles were selected based on their relevance to the clinical questions at hand.

Findings: The incidence of DVT in spinal tumor patients ranges from 2.6% to 5.66% depending on the type of tumor, the type of surveillance, whether symptomatic or asymptomatic DVT was the primary endpoint, and follow-up duration. We have found incidences of postoperative symptomatic SEH ranging from 0.1% to 5.9%, while one prospective study revealed an asymptomatic SEH rate of 58%.

Conclusion: Although the current literature does not allow us to offer a definitive recommendation, spinal tumor patients may benefit from the initiation of prophylactic dose low molecular weight heparin 24 hours after surgery, though the ideal timeframe for discontinuation of this medication is unclear. For those patients felt to be at too high a risk for anticoagulation, IVC filter placement remains the standard of care.

Mind the Gap: Bridging Physician Practices with Published Data in the Respiratory Care of Duchenne Muscular Dystrophy

Bethany Lipa, MD
John Bach, MD

Introduction: Pulmonary complications associated with respiratory muscle weakness in Duchenne Muscular Dystrophy have been well studied over the past several decades. Application of noninvasive intermittent positive pressure ventilation (NIPPV) and mechanically assisted cough (MAC) protocols, along with advances in technology with non-invasive volume and pressure ventilators, have transformed the respiratory management of DMD and reduced morbidity, mortality and length of hospital stay. Despite decades of research and a wealth of published data, surveys performed in North America and Switzerland have confirmed a lack of uniformity in physician practices regarding long-term ventilatory support in DMD. This discrepancy is particularly noteworthy surrounding the decision to educate patients, initiate treatment, schedule interval monitoring and discuss end of life issues revolving around pulmonary care.

Methods: In attempts to further understand the lack of uniformity of care, a review of the literature on pulmonary care in DMD over the past ten years was performed on PubMed and yielded several national consensus statements, one Cochrane review, and numerous small non-randomized studies.

Findings: The data was overwhelmingly in favor of initiating NIPPV in DMD once symptoms of nocturnal hypoventilation were present, and revealed improved survival, quality of life, physical activity, and hemodynamics. One exception noted in the Cochrane review, was the discovery of only weak evidence of short-term alleviation of chronic hypoventilation symptoms with nocturnal mechanical ventilation, suggesting the need for larger randomized control trials to confirm long-term beneficial effects of nocturnal mechanical ventilation and to assess its cost-benefit ratio.

Conclusion: Despite the lack of international guidelines for the standardization of respiratory care in DMD, literature exists to support the implementation, monitoring and cost effectiveness of NIPPV in DMD. Although the supporting literature is mainly from non-randomized studies, most would argue that randomizing patients is unethical given evidence of improved quality of life and prolonged survival with the use of NIPPV. Exposure should be universal and never limited by a physician's lack of knowledge of the literature or their own belief systems. Given the vast amount of literature, health care professionals should be aware of the therapeutic respiratory options available for patients with DMD, including NIV and MAC protocols, and be able to appropriately discuss these options with the patient and their family.

McKenzie Method in treatment of Acute Lumbar Radiculopathy

Amrish Patel, MD, PT
Rex Ma, MD

Introduction: The purpose of this review was to assess the use of McKenzie evaluation and treatment in acute lumbar radiculopathy. Low back pain has been a large burden on public health and has substantial healthcare cost and is a leading cause of disability in people ages 20-50 and is one of the leading causes of missing work. Approximately 70-85% of the adult population will experience at least one episode of low back pain at some time in their lives. Americans spend approximately 50 billion dollars a year in treatment for low back pain. It is the second most common neurological ailment in the United States second only to headaches. The lifetime prevalence of low back pain is estimated to be at least 60 to 70 percent. Although most patients self-treat back pain and only 25 to 30 percent seek medical care,

The McKenzie protocol classifies back pain in one of three categories: postural, dysfunction or derangement. In this review we looked at the use of McKenzie based exercises in the treatment of acute lumbar derangement.

Methods: To find articles on the effect of the McKenzie protocol or extension based exercises for the treatment of acute lumbar radicular pain Medline, Ovid, Pub Med were searched for keywords: acute low back pain, acute radiculopathy, McKenzie Protocol, Physical Therapy, and Rehabilitation. Further references were obtained by examining the references for the found articles. Acute lumbar radicular pain was defined as pain, muscle tension, or stiffness localized to the lumbar region, above the region of inferior gluteal folds and below the costal margin with pain radiating down one or both lower extremities. The classification scheme used to determine acute low back pain was based on the Quebec task force definitions as follows: acute low back pain is less then 6 weeks of symptoms, sub acute as 6 weeks to 3 months and chronic as greater then 3 months.

Findings: One case report was found that reported the acute onset of left sided low back pain and gluteal pain that worsened with forward flexion. This supported the use of McKenzie mechanical diagnosis and treatment may be beneficial in patients with lumbar disc derangement syndrome. Five trials reported on acute low back pain, one of which included patients with radicular pain. Many trials reported a generic McKenzie approach, treatment consisting of just extension exercises. A prescriptive validation pilot study looked at extension mobilization treatment in a small number of patients. The overall outcome supported that by classifying patients with low back pain and matching a specific conservative management plan results in a more effective outcome and compared to those that have unmatched nonspecific treatments.

Conclusions: There is some evidence that the McKenzie protocol is more effective than passive treatment of acute low back pain. However more studies are needed to validate McKenzie Method of classification and treatment of acute lumbar radicular pain.

The Efficacy of Synvisc versus Euflexxa in knee osteoarthritis viscosupplementation: a Review

Kelly Scollon-Grieve, MD
Gautam Malhotra, MD

Introduction: Osteoarthritis is the most common degenerative rheumatologic disease, resulting in significant morbidity and health care expense. The disease is characterized by several pathological events, including progressive erosion of the articular cartilage, synovial inflammation, and changes in the viscoelasticity of synovial fluid due to the decrease in hyaluronic acid (HA), which is a major component of the synovial fluid and a major constituent of a layer on the surface of the articular cartilage. The current management of osteoarthritis of the knee involves the use of both pharmacological and non-pharmacological strategies, including intra-articular injections of HA that are aimed at decreasing pain and improving joint function by restoring joint homeostasis. Most HA products are derived from chicken combs. Of these, Synvisc, which was approved by the U.S. Food and Drug Administration (FDA) in 1997, has been the most widely studied. Synvisc is composed of two cross-linked derivatives of hyaluronan (CL-HA): solid hylan gel particles and soluble hylan molecules described as having a molecular weight of 6 million Daltons. Euflexxa, approved by the FDA in 2004, is a high molecular weight hyaluronan produced from a non-avian source. It is bioengineered 1% sodium hyaluronate produced from biological fermentation resulting in a molecular weight of 2.4-3.6 million Daltons.

Methods: A systematic computer-based literature search was performed using the Cochrane Database of Systematic Reviews, Medline and PubMed using the keywords: *viscosupplementation, Synvisc, Euflexxa, osteoarthritis, hyaluronan,* and *hyaluronic acid.*

Findings: In one prospective, multicenter, randomized, double-blinded trial comparing Euflexxa and Synvisc for viscosupplementation in knee OA, the effectiveness of Euflexxa was not inferior to Synvisc and there were significantly higher incidence of post-injection effusion in the Synvisc group. There are numerous prospective randomized controlled trials comparing the efficacy of Synvisc to that of other hyaluronan products as well as to placebo and corticosteroid injection. Although the results of these studies are heterogeneous, they generally support the use of HA products in the treatment of knee OA.

Conclusion: Given that there is only one published randomized control trial comparing the efficacy of Synvisc and Euflexxa, further research needs to be done in this area.

PART III

Listing of
Meeting Presentations and Posters

Musculoskeletal ultrasound in the diagnosis and management of a glenoid labrum ganglion cyst: a case study

Neeti Bathia, MD
Gerald Malanga, MD

Background: A 36 year old right-handed physician and triathlete with a history of chronic intermittent left shoulder pain of insidious onset without prior discrete trauma presents with worsening pain for one year since the birth of her second son. Pain has worsened with carrying her son, and became much worse a few weeks prior to her initial evaluation after attempting a single arm push-up with a personal trainer. Pain is on average 4/10 in severity, intermittent, located over the anterior and posterior shoulder, and is aching in nature. The pain is mostly exacerbated with running and lifting objects, and has not improved with diclofenac patch use. There is no associated weakness, sensory deficits, paresthesias, or diminished range of motion.

On exam, Inspection revealed minimal left infraspinatus atrophy and mild scapular winging. Range of motion of the left was normal in all planes. She was tender to palpation on the posterolateral aspect of the shoulder. Manual muscle testing revealed pain and give way of the left deltoid and 4+/5 weakness of the left supraspinatus and infraspinatus. Neer's and Hawkin's maneuvers were not indicative of rotator cuff impingement. Sulcus sign was positive bilaterally, and apprehension sign was mildly positive with excessive range of motion in internal and external rotation.

Design: Case Study

Results: Differential diagnosis included chronic supraspinatus tendinosis, tear of the glenoid labrum, and multidirectional shoulder instability Diagnostic testing was as follows: Left shoulder MRI arthrogram showed an enlarged superior-posterior paralabral ganglion cyst measuring up to 5.6 cm in diameter and extending through spinoglenoid notch with an accompanying extensive SLAP tear of glenoid labrum. Left shoulder diagnostic ultrasound showed a large posterosuperior labral cyst measuring 2.5 by 1.5 cm and normal biceps tendon and rotator cuff tendons. The cyst was aspirated with ultrasound guidance and a 4 week course of P.T. was prescribed.

Conclusions: Patient was pain free after procedure and returned to her prior level of function

Pure mixed transcortical aphasia following a left posterior parietal lobe intraparenchymal hemorrhage: a case report

Neeti Bathia, MD
Kimberly Heckert, MD, Anna Barrett, MD

Background: A 90 year old woman with hypertension who sustained a left posterior parietal intraparenchymal hemorrhage (IPH) presented to an acute rehabilitation hospital 5 days after this event. On initial exam, she had a dense right hemiplegia, spatial neglect, and a nonfluent aphasia characterized by impaired verbal/written comprehension, anomia, only one spontaneous verbalization (her first name) and preserved repetition, with indiscriminate repetition of the examiner's words and phrases. Throughout her hospitalization, the patient's communication improved. At post-stroke day 8, she demonstrated better comprehension (gestured appropriately to simple questions), but echolalia persisted. By day 10, she read aloud simple sentences, followed one-step verbal/written commands, and named some common objects. At 2 weeks, spontaneous speech included phrases and sentence fragments. Echolalia improved, though it recurred with high emotion or frustration.

Design: Case Study

Results: Pure mixed transcortical aphasia (Benson, 1979) is rare, with most cases resulting from left frontal or extrasylvian brain lesions, sparing classical speech areas. Early case descriptions (Geschwind et al., 1968; Heilman et al., 1976; Kertecz and McCabe, 1977) reported modest spontaneous improvement, suggesting a poor prognosis for recovery, but systematic recovery studies in this syndrome are not available. Prompting repetition without associated language meaning may not enhance linguistic semantic processing, which is deficient in this syndrome. Yet, it is not clear if optimal behavioral language therapy, currently the care standard for this disorder, should be structured to employ (Pulvermuller and Schonle, 1993) or avoid repetition.

Conclusions: Observable spontaneous recovery occurred during rehabilitation in this patient with pure mixed transcortical aphasia following left posterior parietal hemorrhage. To design an interdisciplinary program of rehabilitation for these patients, specific information is needed about 1) the natural recovery profile for patient stratification, 2) benefit or adverse effect of co-planned physiologic medical treatments, and 3) whether optimal early speech-language training should employ repetition tasks (a la Pulvermuller), or avoid them (e.g. nonlinguistic communication such as gestures, pictures) to enhance the function of disconnected language meaning systems.

Constraint-induced therapy in a hemiparetic patient with pre-existing paraplegia: a case study

Neeti Bathia, MD
Yekyung Kong, MD

Background: A 58 year old right handed man with a 35 year history of T7 complete spinal cord injury (SCI) was admitted to an acute rehabilitation hospital six days after sustaining a right pontine infarct with resultant left hemiparesis. On admission, he had no voluntary movement of his left upper limb or his bilateral lower limbs. He required maximum assistance for sitting balance, dressing, grooming, and all transfers. Prior to this infarct, he was independently mobile in a manual wheelchair, independent with all activities of daily living and worked as a human resources manager at a large company.

Design: Case Study

Results:Ten days after admission, left shoulder elevation was 1/5 in strength. By day twenty, he had anti-gravity left shoulder elevation, left elbow flexion to thirty degrees and left wrist extension to forty-five degrees and required minimum assistance for upper body dressing and grooming, but otherwise had not improved functionally. He began constraint induced therapy (CIT) for three hours/day. At day 28 he was independent with upper body care and grooming, required minimum assistance for lower body dressing and moderate assistance for transfers.

Conclusions: Prior studies have shown that SCI patients are living longer (Geisler et al 1983), and now have at least the same incidence of stroke as the general population (Nam and Odderson 1993). Paraplegic patients who suffer subsequent hemiparesis face unique rehabilitation and psychosocial challenges, particularly if transitioning from an independent to a dependent lifestyle. Standard rehabilitation techniques for stroke must be modified in the paraplegic patient. In this case, a paraplegic patient undergoing a modified form of CIT made significant functional gains, although whether these gains resulted from a natural recovery of neurologic function or the therapy protocol is unclear. Further study in paraplegic patients who suffer subsequent hemiparesis is warranted to find ways to better adapt conventional stroke therapy to these patients.

A Typical Brachial Plexopathy Secondary to Compression From a Large Glenohumeral Effusion: A Case Report

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Case Description: A 48 year-old male with right shoulder pain and with history of HIV presented with acute right shoulder pain for 2-3 weeks without known trauma or injury. Since the onset of pain, the patient reported multiple dislocations of the shoulder, sometimes requiring intervention for relocation and other times self-relocating. Physical examination at the initial evaluation was limited due to pain. Occupational therapy was initiated for range of motion exercises. At two week follow up, the patient reported mild improvement in pain. Significant atrophy of the shoulder girdle muscles and weakness throughout the right upper extremity were noted. Clinically, the patient appeared to have a brachial plexopathy. Electrodiagnostic evaluation was not tolerated. Shoulder/chest MRI's revealed a large glenohumeral joint effusion with distension of the subscapularis muscle. This mass effect led to compression of the brachial plexus resulting in edema within the plexus. This confirmed the clinical findings of brachial plexopathy. Attempts to aspirate joint were unsuccessful. Follow-up MRI two months later revealed significant decrease in glenohumeral effusion and resolution of edema within the brachial plexus. Six months after symptomatic onset, the patient demonstrated significant improvement, with full strength in the right arm except for the shoulder girdle muscles, which had antigravity strength.

Discussion: Brachial plexopathy can be caused by multiple etiologies, including trauma, irradiation, entrapment and tumor invasion. It can also be caused by extrinsic compression, including tumors, lymphadenopathy, abscesses, and metastatic disease. This is the first reported case, to our knowledge, of a compressive brachial plexopathy resulting from a glenohurneral effusion. This is validated by the symptomatic improvement in correlation with the improvements noted on the MRIs. Glenohumeral effusion is an unusual cause of compressive brachial plexopathy and should be added to the differential for the mechanism of injury in brachial plexopathies.

Pronator Syndrome from Wheelchair Use in a C7 ASIA A Tetraplegic: a Case Report

Miguel Coba, MD

Mylan Lam, MD, Jeffrey Cole, MD.

Setting: Acute Rehabilitation Hospital.

Patient: A 34 y/o male C7 ASIA A tetraplegic.

Case Description: This patient is traumatic SCI patient, who was five months status post his acute injury and progressing well towards his rehabilitation goals. However, at this point of his acute rehab he started to complain of pain in his right hand starting at his wrist and extending to his first through third finger. He also started experiencing some difficulty with pronation and regressed slightly with the progress he had made with finger flexion. An MRI was performed to rule out posttraumatic syringomyelia, which was negative. The patient's wrist splint that was used to prevent contractures was adjusted; however, he continued to experience pain. He then underwent an EMG which showed evidence of median nerve entrapment at the elbow consistent with pronator syndrome. Upon further evaluation it was observed that he was excessively using pronation to propel his wheelchair. He was instructed on technique modification for wheelchair propulsion, given appropriate therapy for median nerve entrapment at the elbow, and his wheelchair was modified to help prevent pronation propulsion. Consequently, there was significant improvement of symptoms by time of discharge.

Assessment /Results: At follow up the patient was using the new techniques that he had learned and the wheelchair's modifications. At that point he had near full resolution of his symptoms. Further developments will be discussed.

Discussion: The most common median nerve entrapment is carpal tunnel syndrome, and it is particularly common in wheelchair athletes. However, pronator syndrome is a relatively rare cause of median nerve entrapment, and to our knowledge, this is the first case of pronator syndrome in a tetraplegic directly related to wheelchair use.

Conclusion: Pronator syndrome may be more common in wheelchair users that have decreased grip strength and depend on pronation and elbow flexion for propulsion than previously thought.

Varicella zoster myelitis presenting as Brown-Sequard syndrome in an HIV/AIDS patient after receiving lumbar epidural steroid injection: a Case Report

Margaret M. Donlon, MD, MPH
Barbara Benevento, MD

Background: 32 year-old male with HIV/AIDS presented to a hospital with severe low back pain after having failed conservative treatment with ibuprofen. MRI of the spine at that time was unremarkable. He received a lumbar epidural corticosteroid injection and was discharged home. 2 days later, his back pain worsened and he developed new onset of right-greater-than-left lower extremity weakness, as well as a vesicular rash on his face and lateral thigh. Repeat MRI revealed 2 intramedullary lesions on the right side of the thoracic cord at T4 and T5 without cord compression. Cerebrospinal fluid was positive for varicella zoster virus by polymerase chain reaction, confirming the diagnosis of disseminated herpes zoster. Treatment was initiated with acylovir, vancomycin and dexamethasone. In spite of treatment, lower extremity weakness progressed and patient also developed neurogenic bowel and bladder. Once medically stable, patient was transferred to an acute rehabilitation center. On admission, examination revealed T11 ASIA B paraplegia and Brown-Sequard syndrome with right lower extremity paresis and a left-sided T11 sensory level to pinprick.

Results: After 7 weeks of rehabilitation, patient was re-classified as T12 ASIA D. He was ambulating up to 50 feet with a walker and right molded ankle-foot orthotic, and was discharged home with continued outpatient therapies.

Discussion: Although a few cases have been reported of herpes zoster outbreak after epidural corticosteroid injection, this is the first reported case, to our knowledge, of varicella zoster myelitis after such a procedure. The prognosis of varicella zoster myelitis can vary from death to complete recovery; our patient regained moderate functionality after therapy.

Conclusion: Although the temporal relationship between corticosteroid injection and development of varciella zoster myelitis does not imply causality, caution should be exercised when performing injections in immunocompromised individuals. Inpatient rehabilitation may be beneficial for certain patients with varicella zoster myelitis.

Long-term outcome in patients with critical illness polyneuropathy and myopathy

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Background: Critical illness polyneuropathy (CIP) and critical illness myopathy (CIM) are frequent causes of weakness in the intensive care unit. These diagnoses are becoming increasingly common because of improved survival from sepsis, and therefore more likely to be encountered in rehabilitation settings. The pathophysiology for CIP/CIM has been written about extensively in the acute care literature but less is known about long-term outcome. A literature review was therefore undertaken in order to establish what is known about the course of recovery in CIP/CIM and to illuminate areas that need further research.

Methods: A review of the literature was completed through PubMed and OVID, using the search terms "critical illness polyneuropathy" combined with "long-term outcome" or "prognosis" or "function." The search revealed 209 articles that were narrowed down to 23 rehabilitation-relevant articles. From this group, thirteen primary articles, two case reports and one review article were selected.

Findings: Mortality among patients with CIP/CIM is as high as 50% by 1 year. Of those who survive, the majority have some degree of improvement. The long term prognosis ranges from complete recovery within months to persistent weakness and disability after several years. Recovery time in CIP is somewhat dependent on the severity of neuropathy and distance over which axonal regeneration must occur. Compression neuropathies are a cause of permanent seqeulae in patients with CIP. CIM may have a better long-term prognosis than CIP.

Conclusions: The overall quality of the majority of studies was poor to fair. Many of the studies used non-statistical analysis and less than half were prospective. Outcome measures were often limited to manual muscle strength or ability to ambulate, which do not necessarily correlate with function. Future studies should include several validated functional measures and involve multiple follow-up points, so that an accurate trajectory of recovery can be delineated.

Weight-Bearing MRI: Comparison of Knee Angle Set-Up Methods and the Effect of Real-Time Visual Feedback

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Objective: Acquiring MR images from an upright scanner is challenging because of limited space. In order to provide improved techniques for the early evaluation of knee osteoarthritis, subjects need to: 1) accurately target a knee flexion angle (KFA); and 2) maintain this target for the duration of an MRI scan. The goal of this study is to find the most effective method to target and maintain a KFA for the duration of an MRI scan.

Participants: Eight healthy individuals (3 females, 5 male, 30.6$\pm$8.5 years) participated in the pilot study.

Methods: Subjects were outfitted with reflective markers, from which a reference KFA was calculated using Vicon Plug-In Gait. From an upright, neutral stance, subjects then targeted a 20° KFA using three different targeting methods: goniometry, homemade knee jig, and ShapeSensorMRI (an MRI-compatible 1 d.o.f. motion sensor). Each targeting method was compared to the angle calculated from Vicon. An additional ShapeSensorMRI trial was run in which real-time feedback was provided, and its effect was investigated by examining the deviations in signed error between the ShapeSensorMRI trials.

Results: No significant difference in signed error was found between the methods in their ability to target a KFA (two-tailed paired t-test, $p>0.05$). However, a one-tailed paired t-test showed that the deviation of the signed error increased significantly over the duration of data collection, $p<0.05$, for all angle set-up methods without feedback. When feedback was added though, there was significantly less deviation from the intended KFA throughout the scan time.

Conclusion: The ShapeSensorMRI appears to be less effective than the goniometer and knee jig in targeting KFA. However, when providing feedback, the ShapeSensorMRI may enable subjects to more easily control their postures, reducing the need for repeat scans due to inaccurate positioning and motion artifact.

Assessment of Current Pain Management Education In Physical Medicine and Rehabilitation Residency Programs

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Objectives: Chronic pain is responsible for 90 million doctor visits per year, yet physicians report low confidence treating chronic pain. Many feel they needed more training during residency. We seek to determine if residents in PM&R feel they are being adequately trained to address pain management issues, and to assess what methods are currently being used.

Design: Participants completed a survey on surveymonkey.com. Similar surveys with 12 and 17 questions, respectively, were sent to the program directors and residents of all U.S. Physical Medicine and Rehabilitation residency programs. The questions focused on the methods and amount of classroom and clinical pain exposure.

Results: The survey was completed by 80 residents and 32 program directors. Overall, most residents felt somewhat satisfied with their training. They felt their training was lacking injection procedures (spinal, joint, and nerve blocks), management of implantable devices, and complementary and alternative medicine. Residents reported only occasional exposure to patients with cancer pain, complex regional pain syndrome and implantable devices. They reported relatively frequent exposure to fibromyalgia patients, and very frequent exposure to patients with acute, chronic and neuropathic pain. Program director responses were similar to residents with some discrepancies. Program directors reported more hours spent in pain management didactics, with topics discussed at greater lengths. They also reported that residents had more exposure to patients with cancer pain, fibromyalgia, and complex regional pain syndrome.

Conclusions: Residents in PM&R feel they will not be totally comfortable treating acute and chronic pain patients upon graduation. The data suggests areas for improvement include inclusion of a pain rotation, increasing the depth of pain management topic didactics, and increasing procedural experiences.

Inflammatory myopathy in a diabetic presenting with foot drop: a case report

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Case Description: 29 y/o male referred for electrodiagnostics with complaints of progressive foot drop and ataxia for one year. Pt. has PMHx of poorly controlled diabetes type I (diagnosed 14 years prior), hyperlipidemia (with current statin use), hypertension, and depression. HPI revealed proximal and distal weakness in upper and lower extremities, and numbness in stocking and glove distribution. Lumbar MRI showed disc herniations with no stenosis. The patient denied back pain, radicular pain, muscle aches, or family history of neurologic conditions or weakness. Physical exam revealed diffuse atrophy in all extremities, proximal and distal weakness with trace bilateral ankle dorsiflexion, absent reflexes, and normal muscle tone. Electrodiagnostics revealed a sensorimotor peripheral polyneuropathy with neuropathic findings on EMG without specific myopathic features. Lab studies revealed CPK >1000, elevated aldolase, ESR >100, and negative rheumatologic panel. Muscle biopsy was suggestive of a chronic myopathy, possibly inflammatory, with features of neurogenic atrophy.

Results: This patient's clinical picture and diagnostics are suggestive of multifactorial weakness- due to an chronic inflammatory myopathy- polymyositis vs. statin induced myopathy, with a superimposed diabetic neuropathy. The patient has been discontinued from statins, started on Prednisone and Imuran, fitted with bilateral AFOs, and treated with PT. His functional status remains stable with ongoing treatment.

Discussion: Correlation of thorough history, physical exam and diagnostics is essential for appropriate diagnosis and treatment. EMG findings for this patient were more suggestive of neuropathic findings, however physical exam suggested a myopathic process. Through laboratory and histologic studies a more complete pathophysiology and plan for treatment was formed.

Conclusions: Weakness can be multifactorial, due to myopathy and neuropathy simultaneously. Complex cases where history and physical do not correlate with diagnostic findings necessitate further investigation and cross specialty physician collaboration to achieve the best patient outcomes.

It's the Nerves! – A Case Series of Neurological Causes for Pelvic Pain Syndromes

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Introduction: Chronic pelvic pain is a common problem encountered in outpatient clinics run by specialists such as Urologists, Gastroenterologists, Internists, Neurologists, Psychiatrists, and Anesthesiologists as well as Physiatrists. It is usually described by the Urologists as Prostatitis Syndrome, Chronic Pelvic Pain Syndrome (CPPS A and B), or as Pelvic Floor Dysfunction and the symptoms are attributed to the pelvic cavity or the pelvic floor. About 10-20% of urological visits are estimated to be due to patients with such symptoms.

Method: Here we report a series of 6 cases of male patients who were diagnosed with pelvic pain or prostatitis like symptoms, but were later found to have either a peripheral or central neuropathic cause for their pain.

Findings: Cases 1 and 2 describe central neurological causes for chronic pelvic pain. The patients mentioned here had relief from symptoms following treatment for lumbar pathology.
Cases 3 and 4 describe peripheral neurological causes for CPPS - such as genitofemoral neuritis secondary to inguinal hernia.
Case 5 describes a presentation of Lyme disease with Babesiosis - causing peripheral inflammatory neuropathy and prostatitis like symptoms.
Case 6 presents a Diabetic with peripheral sensorineuropathy and symptoms of chronic pelvic pain syndrome.

Conclusions: In each of these cases, the treatment of the particular neurological problem helped relieve the patients of their pelvic symptoms. These findings offer encouraging prospects for further investigation into neuropathological causes of pelvic pain syndrome in males, and to develop appropriate management strategies.

Pulsatile Tinnitus and Conjunctival Injection as Presenting Symptoms of Carotid Cavernous Fistula after Stroke

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Case Description: A 90 year old female presented to inpatient acute rehabilitation on day 18 post-right MCA infarct. On initial evaluation the patient complained of having a "whooshing" tinnitus in her right ear since her stroke along with a mild right sided temporal headache. Physical examination revealed ptosis and scleral injection on the right along with a left sided facial droop. On further otoscopic examination no clear etiology of her tinnitus was identified. Her scleral injection was believed to be secondary to exposure keratitis from the incomplete closure of her right eyelid. It was treated conservatively during her admission with topical lubricants however minimal benefit was obtained. The patient progressed well with rehabilitation during her admission but her tinnitus and conjunctival injection persisted upon discharge. Ten days after discharge from our facility she presented to her ophthalmologist with the complaint of persistent right eye pain. On examination she was found to have a right orbital bruit, mild proptosis, and conjunctival injection. The ophthalmologist was highly suspicious of a carotid cavernous fistula (CCF), a spontaneous or acquired fistula between the carotid arterial system and the venous cavernous sinus. A CCF classically presents with conjunctival injection, proptosis, visual impairment, and orbital bruit. The ophthalmologist referred the patient to a local hospital for immediate evaluation. CT angiogram confirmed the presence of a right sided carotid cavernous fistula and the patient underwent successfully embolization of the fistula the following day.

Conclusion/Discussion: This case provides a powerful lesson. Although it is common for patients to present with ptosis following stroke or severe head injury, we must not fail to auscultate the orbit. In our patient's case, had we been more familiar with the clinical signs of CCF or simply auscultated her orbit, we could have identified her potentially deadly fistula prior to discharge.

Tetraplegia in a Patient Found to Have Os Odontoideum Defect After Evaluation for Guillain-Barre

Richard P. Hoppe, MD
MyLan Lam, MD

Patient: A 44-year-old woman with PMH of rhematoid arthritis presenting with tetraplegia and ventilator dependant respiratory failure.

Case Description: Patient was initially admitted after a suspected upper respiratory infection due to worsening labored breathing and mild weakness. The patient was deemed to be in respiratory distress on presentation to the acute care hospital and was intubated. There was a suspicion for Guillain-Barre. Attempts were made to wean the patient from the ventilator but these failed and she was reintubated on 2 separate occasions. The patient had worsening weakness and was now unable to move any of her extremities. An electromyography/NCS study, as well as a lumbar puncture, were performed but the findings were inconsistent with Guillain-Barre. A cervical spine magnetic resonance imaging was performed and the patient was found to have an Os odontoideum defect, with severe cervical stenosis and spinal cord compression. She had an occipito-cervical fusion performed for stabilization. She eventually also had a tracheostomy due to continued respiratory failure and PEG placement to facilitate feeding and medication administration due to poor PO intake. She was transferred to an acute rehabilitation facility for further care. On our exam, she was found to have hyperreflexia and spasticity in the lower extremities, scattered sensory changes, and a positive Hoffmann's sign, as well as extensive hand atrophy, findings more consistent with a myelopathy over a disorder of denervation. She began a comprehensive physical therapy/occupational therapy program.

Assessment/Results: The patient was able to have her HALO replaced by a hard cervical collar, and with comprehensive therapy regained upper and lower extremity strength to be able to perform activities of daily living at a minimum assist level, but she is not yet ambulating. She is still on the ventilator at night but is tolerating tracheostomy capping during the day.

Conclusions: It is important to keep a broad differential diagnosis for patient's presenting with weakness and to seek out other causes such as myelopathy and orthopedic defects when more common causes are ruled out, or are not consistent with physical exam.

A dynamic speed vs. accuracy Trade-off (DSAT) paradigm for measuring and training grip force control for stroke population

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Objective: A fundamental principle of human motor behavior states that the accuracy of targeted movements relates reciprocally to their speed. This is quantified by Fitts' Law, wherein movement time (MT) and index of difficulty (ID), the $\log_2$ ratio of target distance (A) to target height (H) has logarithmic linear relationship; $MT = a+b\cdot\log_2(2A/H) = a+b\cdot ID$. The slope, b (seconds/bits), measures targeting performance as the time spent at each difficulty level, expressed as bits of information to be processed by the neuromotor system. Fitts' paradigm is a common measure of the kinematic performance of the upper limb, but has not been applied to its dynamic performance. Herein, we developed a dynamic speed-accuracy trade-off (DSAT) test of grip force modulation, which can be used both for assessment and training.

Methods: Grasping force was measured with a grip force dynamometer (GFD), as described previously. The GFD was designed to maximize the radial contact between the five metacarpal bones and the sensors in order to accurate register true cylindrical grip force. Four strip force sensitive resistors (Model #408, Interlink Electronics, CA, USA) were placed longitudinally on the surface of a plastic cylinder (4 cm diameter x 10 cm longitudinal). Total weight of GFD was about 40 g. Using a half-bridge circuit, the raw voltage output was sampled at 100 Hz with a 12-bit digitizing device (NI-DAQ-6008). Dynamic response of the sensors was corrected with a 3rd order polynomial multiplier to be approximately linear up to 4 Kg of applied force (correlation, $r > 0.9$). Force data were smoothed bi-directionally by a second-order low-pass Butterworth's filter prior to all analyses.

Results: Healthy subjects exhibited a high correlation coefficient (R^2=0.95) to Fitts behavior with a slope constant, b, of 0.11 ± 0.006 s/bits. The baseline behavior of stroke subjects (average of first 3 days) deviated from log-linearity, having a correlation coefficient of only 0.71. Baseline slope for stroke subjects was 0.70 ± 0.12 s/bits. After 6 weeks of training with DSAT, the stroke group, during their final 3 days of training, exhibited a high correlation coefficient of 0.97, and reduced slope of .22 ± 0.02 s/bits.

Conclusion: This study demonstrated that grip force behavior, in terms of speed versus accuracy, can be characterized according to Fitts' paradigm. By the nature of the instrument being used, the DSAT test was essentially isometric, and movement was artificially generated by transducing grip force to the height of the display bar, so that MT represents time to change the grip force from one level to another. Recovery of fine motor control has received relatively little attention relative to the emphasis place on gross motor tasks, ambulation, and non-motor skill. Few previous studies that directly attacked the problem have successfully demonstrated the ability of the damaged CNS to regain function using protocols such as biofeedback driven finger motions. Thus, there is much need for new technologies that will provide users with a comfortable, intuitive training environment to promote a long-term and rigorous rehabilitation program for fine motor control. The DSAT tool seems to be effectively engaging a sufficient amount of manageable challenges for users with stroke to endure their rigorous re-training regimens.

Ultrasound-Guided Intra-Articular Hylan G-F 20 Injection for Hip Pain Due to Avascular Necrosis: a Case Report

Chiawen L. Liang, MD

Case Description: The patient with history of chronic steroid use for pulmonary disease presented with severe, intermittent right hip pain for 6 months. He denied any trauma or surgery at the right hip. Physical exam revealed significant leg length discrepancy (LLD) with a shorter left leg. There was significant pain on palpation over the right groin, and at end range of the right hip. X-rays and CT scan showed irregularity and thinning of the subchondral bone with cartilage loss consistent with right femoral head avascular necrosis (AVN). At the time, the patient preferred to defer surgical interventions. He was treated with a left shoe lift to correct the LLD and a course of physical therapy. He also received ultrasound-guided intra-articular injections of Hylan G-F 20 (Synvisc) into the right hip joint once a week for 3 weeks.

Assessment/Results: He returned to the clinic a month later and reported a significant improvement in pain of at least 50% in the right hip. No side effects or complications were observed.

Discussion: AVN of the hip can lead to significant disability and conservative management is usually limited and often minimally effective. Viscosupplementation is a well-accepted therapeutic treatment for knee osteoarthritis, but limited data exist about its potential benefit for the treatment of hip pathology and/or AVN. This is the first reported case, to our knowledge, of the successful use of intra-articular viscosupplementation (Hylan G-F 20) for hip pain due to avascular necrosis.

Conclusion: Hylan G-F 20 appears to be a safe and effective intervention for the treatment of hip AVN and can be considered a treatment option along with other standard conservative interventions. Further studies are needed to validate these findings.

Hypokalemic Periodic Paralysis with Psoriatic-like Lesions: a Case Report

Chiawen L. Liang, MD
John Bach, MD

Case Description: A 51-year-old woman with intermittent myalgia, progressive muscle wasting and paresis. The patient reported history of painful nocturnal muscle spasms and fasciculations in the legs, and progressive weakness in the shoulder and hip girdles, resulting in difficulty with ambulation. Her son and aunt had similar complaints. She also had recurrent scaly erythematous psoriatic-like skin lesions located at the trunk, elbows, knuckles, thighs and buttocks, which only improved with resolution of paretic attacks. Physical exam revealed motor strength of 4/5 in the shoulder and pelvic girdles. Cranial nerves, deep tendon reflexes and sensory examination findings were normal.

Assessment/Results: She had extensive studies, including MRI of the brain, abdomen, and the whole spine which were all normal. Serology studies for Lyme, Babesiasis, lupus, rheumatological markers were neg. CK, Aldolase, and ESR were normal. CRP was elevated. Potassium (K) level was low normal. The EMG findings showed myopathic irritation and early motor unit recruitment. As a result, the diagnosis of hypokalemic periodic paralysis (HypoPP) was established and she was started on K-Dur, acetazolamide and spironolactone for K conservation. Diet was modified to decrease carbohydrate intake. Symptoms had improved despite only mildly elevated K level.

Conclusion: HypoPP is autosomal dominant, sparing facial and respiratory muscles, caused by mutation in the skeletal muscle calcium and sodium channel genes. Attacks of paresis are spontaneous, provoked by resting after exercise, carbohydrate-rich meals, or insulin. As in our patient, HypoPP is often underdiagnosed due to normal-to-slightly decreased K level during attacks and normal level in between. This is the first reported case, to our knowledge, of psoriatic-like lesions associated with attacks of HypoPP. We propose a possible underlying ion channelopathy as the common mechanism for both muscular and skin diseases, but further genetic analysis is required.

Not All Radiating Leg Pain is Radiculopathy: Obturator Nerve Injury After Total Abdominal Hysterectomy and Bilateral Salpingo-oophorectomy (TAH-BSO)

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Eric L. Altschuler, MD, PhD

Case Description: 43-year-old female with left leg weakness and pain radiating from the groin to the foot, who is status-post TAH-BSO one month prior for endometrial adenocarcinoma. She noted difficulty crossing the left leg since the surgery, and the leg giving away during ambulation. History included left radicular low back pain. Prior MRI showed bulging L4-L5 disk and bilateral S 1 Tarlov cysts. Physical exam was significant for left antalgic gait. Left leg strength: 4/5 hip flexion improved to 5/5 with passive hip adduction at the thigh, 2/5 hip adduction with pain in the medial groin, 5/5 in the rest of left leg. Strength in the right leg, bilateral light touch sensation, reflexes, and straight leg raise were intact. Assessment: Motor nerve conduction studies showed normal distal latencies, amplitudes, and conduction velocities in the bilateral peroneal and tibial nerves. The sural nerve SNAP was absent on the left and showed a prolonged latency on the right. Bilateral tibial H-reflexes were normal. Needle electromyography exam was significant for 3+ spontaneous activities in the left adductor longus, with rare voluntary motor unit action potentials that were small with poor recruitment. The electrodiagnostic evidence is consistent with an incomplete left obturator nerve lesion. The clinical significance of the sural SNAP findings is not clear. Discussion: Etiologies of intraoperative injury to the obturator nerve include patient positioning, direct surgical trauma, manipulation, stretching of the nerve at the bony obturator foramen, suture entrapment, improper retractor placement, and post-operative hematoma. A study of adult cadavers suggested that when surgical patients are placed in lithotomy position, the hips should be flexed whenever there is >30 degrees of abduction of the legs to decrease risk of obturator nerve injury.

Conclusion: Obturator nerve injury must be considered in patients with complaints of weakness after gynecologic surgery. Prognosis is dependent on the severity of injury, complete vs. incomplete nerve damage.

Non-invasive Ventilation in Amyotrophic Lateral Sclerosis

Chiawen L. Liang, MD
John Bach, MD

Design: A literature review of noninvasive positive pressure ventilation (NIPPV) in patients with ALS.

Objective: To summarize the overall literature on the survival and quality of life (QOL) in ALS patients using NIPPV.

Background: ALS is a progressive neurodegenerative disease, affecting both upper and lower motor neurons, resulting in spasticity and diffuse muscular atrophy and weakness. Although ALS has no direct effect on the lungs, it has devastating effects on the mechanical function of the respiratory system. Mechanical ventilator support for ALS patients has proven effective in improving both quality and duration of life. There are two options available: NIPPV via a mouthpiece, nasal or oronasal mask, vs. invasive ventilation via a tracheostomy.

Methods: A review of the literature was conducted using PubMed, OVID and MDConsult using the key terms "ALS and noninvasive ventilation or NIPPV or NPPV or BiPAP or bi-level positive airway pressure." The search produced 49 articles, which were narrowed down to 13 relevant articles. The articles that were rejected were on lung insufflation capacity, gastrostomy insertion with noninvasive ventilation support, and palliative care for patients with ALS.

Results: NIPPV may extend the lives of ALS patients by about 10 months and slow the decline of FVC in the group using >4h/day compared with the group without Bi-PAP. A randomized controlled trial found that NIPPV extended overall survival by 48 days with QOL maintained above 75% of the baseline for significantly longer in patients with NIPPV. In patients with better bulbar function who received NIPPV, there was an extended survival of 205 days. Furthermore, patients may tolerate NIPPV better if it is initiated early before development of prominent respiratory symptoms. A prospective study found improvement in QOL including decreasing dyspnea, improving quality of sleep, and increasing mental alertness and energy to pursue social activities. However, no improvement was found in learning and recall in these patients.

Conclusion: NIPPV can offer patients better quality of life, and delay or eliminate the more invasive intervention of tracheostomy, which is more costly and associates with more discomfort and complications.

Superficial Left Anterior Chest Wall Pain in a Myelopathic Inpatient

Stephanie K. Liu, MD
MyLan Lam, MD

Case Introduction: 51 year-old male with history of multi-drug abuse, remote surgical kidney repair, LGIBs, HTN, stroke causing mild right hand and face weakness, pneumonia 3 weeks prior to acute care admission with new HIV diagnosis (T cells 306), Hepatitis B/C; was admitted to acute care after 5 months of cervical pain and ataxia. Found to have C2-C3 osteomyelitis and spinal cord compression, he underwent decompressive laminectomy and anterior-posterior fusion from C2C5 with C3-C4 corpectomy. Acute care complications: symptomatic anemia requiring blood transfusion, self-limited BRBPR with normal colonoscopy, stage-2 sacral decubiti. Once stable he was transferred for inpatient rehabilitation while completing a 12-week IV antibiotic course. Admission examination scored the patient C4 ASIA-D tetraplegic.

Events: Day 11: he complained of left anterior chest wall pain, reproducible to left lower rib cage palpation. Evaluation included normal EKGs; CXR negative for pneumothorax, effusion or infiltrate; rib x-rays negative for fractures; Doppler US negative for leg clots. Vital signs remained stable, but he frequently requested pain medication, reporting some relief from lidocaine patches. Internal Medicine Consult ordered renal ultrasound to rule out pyelonephritis, and mild left kidney hydronephrosis was shown, without stones or mass. Urology suggested that ultrasound findings were consistent with congenital vs. postoperative vs. benign changes and recommended oral tolterodine and repeat ultrasound in one week. Day 17: outside abdominal CT scan revealed a large, 5.7cm loculated abdominal aortic aneurysm compressing the left ureter. The patient, still hemodynamically stable, was transferred emergently to acute care for vascular surgery evaluation -and management. One day later, notification was received that the patient died-in the emergency room.

Conclusion: In medically complicated incomplete SCI patients, we recommend maintaining a low threshold to order further imaging when intra-abdominal pathology is suspected.

Herpes Simplex Rash after Sacroiliac Joint Corticosteroid Injection

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Introduction: Herpes zoster virus (HZV) reactivation and resultant rash (shingles) is often associated with immunosuppression, or occasionally occurs after local trauma. Similarly, local rash caused by herpes simplex virus (HSV) reactivation can occur by analogous mechanisms. But to our knowledge HSV has never before been reported after intra-articular corticosteroid injection, nor after injections at the sacroiliac joint.

Case Description: We report a 52 year old female who sustained right sacroiliac pain due to a fall. When other treatments failed to give adequate relief, she underwent an intra-articular methylprednisolone injection into the sacroiliac joint, under fluoroscopic guidance. Within 48 hours she developed a vesicular rash on that buttock, immediately adjacent to the injection site. Derrnatologic consultation confirmed that the rash was herpetic. A vesicle was punctured, swabbed, and tested via polymerase chain reaction, which was positive for herpes simplex virus type 2. She was treated with topical antiviral agents with good results. Meanwhile, her sacroiliac joint pain substantially improved.

Conclusion: The case demonstrates local herpes simplex virus reactivation apparently due to local immune suppression from the corticosteroid injection. Interventional pain management physicians should be aware of local herpetic rashes, including simplex, after local corticosteroid injections, so that prompt recognition and treatment may be provided.

Unilateral Predominant Toe Walking Gait in a Patient with Ankylosing Spondylitis – a Case Report

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Case Description: A 55-yr-old male with ankylosing spondylitis complained of progressive pain and difficulty with ambulation for the previous 8 mos. Despite having required multiple disease modifying regimens for more than 20 yrs, he had remained independent with activities of daily living, and he was ambulatory without any assistive device. Eight months before presentation, he began to develop increasingly severe "crunching" pain in his hips and gluteal area, which forced him to lean forward with ambulation, such that he had required the use of a standard walker for the previous 6 mos.

On physical examination, he demonstrated an antalgic gait, forward flexion (35 degrees) at the hips, and a short stride length with a brief left-heel strike, but then an immediate transition to a left-forefoot stance and sagging at the knees into mild flexion. Left-leg midstance to toe-off was notable for toe walking throughout (Fig.). Examination of the hips revealed painful, limited hip range of motion, particularly in internal rotation and extension, with no loss of range of motion at the knees, feet, or ankles. Plain films of the hips showed severe, circumferential narrowing bilaterally, and fusion of the SI joints. Spine films showed significant ankylosis.

Why does this patient walk on his toes on the left foot immediately after an abnormally shortened heel strike? We suggest that the patient's progressive, painful, degenerative loss of hip extension and rotation, combined with an ankylosed/fused spine (thus an inability to compensate with lordosis), leads to anterior migration of his weight line during ambulation. After heel strike, he transitions quickly into a left-forefoot stance, sagging at the knee into mild flexion to avoid the painful terminal knee and hip extension required for left-leg stance. He thereby maintains his center of gravity vertically and his sightline level by rising to his toes with flexed hip and knee during stance.

Discussion: This is analogous to the more familiar case of toe walking in Duchenne muscular dystrophy, the progression of which has been described as follows: weakness in gluteus maximus leads to lumbar lordosis, with all hip extension generated by the hamstrings. Tightness develops in the iliotibial band and tensor fascia lata, causing a wide-based gait. The quadriceps weaken, and to maintain passive stabilization of the weight line in front of knee and behind the hip, the patient rises up on his toes. Lastly, the neck is brought into mild flexion.

Cognitive Reserve and Memory in Multiple Sclerosis

J.F. Sumowski, PhD
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Objective: Cognitive Reserve (CR) represents premorbid neural efficiency / capacity, often estimated with proxies of premorbid IQ. Research has show that when cognition is challenged by neurologic disease (e.g., Alzheimer's Disease), persons with higher CR cope better with increased demands, thereby avoiding / delaying cognitive impairment. This is the first study examining the effect of CR on verbal learning and memory in Multiple Sclerosis (MS). It was hypothesized that persons with MS would perform worse than HC's at lower levels of CR; however, this discrepancy should narrow as CR increases and disappear at higher levels of CR.

Participants & Methods: Fifty-eight persons with MS (Age = 46.6 ± 7.7; Disease Duration = 9.9 ± 7.7 years) and 43 HC's (Age = 43.1 ± 11.2) completed the WRAT-3 Reading Subtest to estimate premorbid CR, and WMS-R Logical Memory subtests to measure verbal learning and memory. Separate multiple regression analyses predicting learning and memory consisted of 4 Blocks: (1) Age, (2) Group, (3) CR, and (4) Group X CR Interaction.

Results: MS diagnosis and lower CR both predicted worse learning and memory (p's < .05), but these effects were moderated by significant Group X CR interactions (p's < .05) such that persons with MS demonstrated learning and memory deficits at lower levels of CR, but these deficits disappeared at higher levels of CR. In fact, persons with MS performed comparably to HC's at higher CR levels.

Conclusions: Higher CR protects persons with MS from disease-related verbal learning and memory dysfunction.

Letter-Number Sequencing Measures Both Working Memory and Processing Speed in Multiple Sclerosis

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Objective: Wechsler Letter-Number Sequencing (LNS) is used to assess WM in clinical and healthy populations, with the assumption that the same cognitive constructs underlie performance within both groups. This study evaluated this assumption by measuring the relative contributions of WM and processing speed (PS) to LNS by persons with relapsing-remitting MS and healthy controls (HC).

Participants & Methods: Forty individuals with MS and 36 HC's were administered LNS, Wechsler Digit Span Backward (DSB) measuring WM, and Symbol Digit Modality Test – Oral Version (SDMT) measuring PS. Regression analyses were performed separately for both groups to identify any unique contribution of PS to LNS performance above and beyond WM. Age, WM, and PS were entered in blocks 1, 2, and 3 respectively.

Results: For HC's, WM predicted LNS in blocks 2 ($\beta = .57$, $p < .001$) and 3 ($\beta = .55$, $p < .001$). PS did not predict LNS in block 3 ($\beta = .03$, $p > .5$, partial correlation = .11). For persons with MS, WM significantly predicted LNS in blocks 2 ($\beta = .72$, $p < .001$) and 3 ($\beta = .61$, $p < .001$). PS predicted LNS performance in block 3 ($\beta = .07$, $p < .05$, partial correlation = .39).

Conclusions: LNS performance relies solely on WM among healthy individuals, but relies on both WM and PS among individuals with MS. This finding raises the issue of clinical test interpretation based on cookbook cognitive task analyses derived from the healthy population.

Spaced Retrieval Improves Memory Retention in Multiple Sclerosis: Clinical Application of the Testing Effect

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Objective: Memory dysfunction is the most common cognitive complaint among individuals with Multiple Sclerosis (MS). Despite this, there is very little memory rehabilitation research with MS samples. The testing effect is a robust cognitive phenomenon within the healthy population by which a spaced retrieval strategy at encoding results in greater later retention than both massed and spaced restudy. The current study is the first to investigate the memory benefits of spaced retrieval with an MS sample.

Participants & Methods: Fifteen individuals with MS (Age: M = 48.7, SD = 7.4; Years Since Diagnosis: M = 13.3, SD = 7.7) participated in a within subjects design. All participants were asked to learn 48 verbal paired-associates (16 massed restudy, 16 spaced restudy, and 16 spaced testing). Delayed cued recall occurred after 45 minutes.

Results: As expected, there was a large linear effect of study type ($F = 30.2$, $p < .001$), such that spaced retrieval ($M = 8.9$) resulted in significantly greater recall than spaced restudy ($M = 6.5$; $p = .001$), which resulted in significantly greater recall than massed restudy ($M = 5.2$; $p < .05$).

Conclusions: In an extension of the testing effect, spaced retrieval was identified as a powerful memory strategy among individuals with MS. These results have important implications for memory rehabilitation, especially given the apparent ease with which spaced retrieval can be employed by patients in naturalistic settings.

Multiple Strategies Used to Maintain Fixed Head Position during Higher–Frequency Anterior-Posterior Oscillations

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Introduction: Our study of postural responses to anterior-posterior (A-P) cyclic perturbations confirmed that as frequency increased, head movement decreased until it was relatively stationary. However, multiple strategies were used to limit head movement. A lower body (LB) strategy fixed the upper body in space while allowing rotation of the lower body about the hip. Alternately, a whole-body (WB) strategy fixed head position while allowing progressively larger linear displacements with increased distance from the head. These multiple strategies may be driven by idiosyncratic characteristics such as body geometry, reaction time, or overall stability. Identification of these drivers could lead to better balance training for athletes and more specific rehabilitation for those with diminished balance.

Purpose: Identify stereotypical muscle activation and kinematic patterns used to establish stable head position at higher-frequency A-P oscillations.

Methods: Motion, force, and EMG data were collected and synchronized for 11 able-bodied subjects standing on a research platform during A-P sinusoidal translations at 0.1, 0.25, 0.5, 0.75, 1.0, and 1.25 Hz with a peak-to-peak amplitude of 12 cm. Each frequency progression was repeated twice.

Results: Five subjects used the LB strategy, five used the WB strategy, and one subject used an atypical strategy that did not fix head position. For the third repetition at 1.25 Hz, the LB strategy had well-stereotyped kinematics, with translations <7.5 mm and rotations <1.4 deg for all joints above the hip. Joint rotation was largest at the hip (10.7±1.4 deg). Mean center-of-pressure (COP) excursion decreased from 148 to 79.5 mm with repetition and was out-of-phase with center-of-mass (COM) displacement. For the WB strategy, kinematic, EMG, and COP/COM patterns were far less consistent. However, the significantly larger mean head displacement for the WB strategy (25.9 vs. 10.6 mm ($p = 0.045$)) decreased with repeated exposure until head displacements for each strategy were not statistically different (9.22 vs. 7.54 mm ($p = 0.51$)).

Conclusion: Although people tended to fix their head in space at higher A-P cyclic frequencies, there was one strategy (LB) that was well-stereotyped and another (WB) that was a collection of unique strategies that were equally effective at fixing head position.

Contralateral Weakness and Fatigue after High-Dose Botulinum Toxin Injection for Management of Post-Stroke Spasticity: a Case Report

Elizabeth Varghese-Kroll, MD
Elie Elovic, MD

Case Description: A 53-year-old woman developed contralateral weakness and fatigue, without autonomic symptoms, two weeks after receiving an injection with 800 units of botulinum toxin A (BTX-A) for management of her post-stroke spasticity. While the patient reported resolution 4 weeks later, clinical evaluations suggested an even longer time course. The patient then experienced the same contralateral symptoms again over a year later, after a 500-unit injection, that took a similar length of time to resolve. We are reporting the first known case of repeated contralateral weakness and fatigue after high-dose BTX-A injection. Currently, dosage is largely titrated by the practitioner based on individual patient response. Prior to performing BTX-A injections for therapeutic purposes, the expected risks and benefits for each patient must be carefully considered.

Musculoskeletal Ultrasound and Its Application for Therapeutic Injections: a Literature Review

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Introduction: Musculoskeletal ultrasound is a clinical tool gaining increasing favor in rehabilitation medicine because of its utility in both diagnosis and therapy of a variety of musculoskeletal conditions. It may be particularly useful in guiding therapeutic interventions such as corticosteroid injections, aspiration of bursae or hematomas, or nerve blocks. Its advantages include its low cost to the patient compared to MRI studies and its lack of radiation. Because of its real-time visualization, it is thought to be more effective than the blind (using anatomic landmarks only) approach.

Method: The review was conducted using PubMed, Ovid and MDConsult using the search terms "musculoskeletal ultrasound injections" and "therapeutic musculoskeletal ultrasound injections" up to January 2007. The search revealed 24 articles in Ovid and PubMed that were narrowed down to 14 with relevance to the rehabilitation setting, and 108 separate articles were found in MDConsult that were narrowed down to 8 rehabilitation-relevant articles.

Findings: The literature suggests that use of musculoskeletal ultrasound may lead to significant improvements in patient care. Ultrasound improves accuracy of injections because of the ability to visualize both needle and target. Ultrasound is also advantageous because of the practitioner's ability to change the needle path in real time and observe medication delivery as it occurs. As well, this modality can decrease adverse effects of inaccurate needle placement such as nerve/vessel injury or tendon rupture. No significant complications associated with the use of musculoskeletal ultrasound were reported.

Conclusion: We conclude that musculoskeletal ultrasound is a useful tool for therapeutic injections that the literature suggests can meaningfully impact patient care by increasing the accuracy and reducing the risks of the blind approach. A double-blinded randomized controlled trial of injections using anatomic landmarks vs. ultrasound-guided injections is necessary. However, this literature review illustrates that ultrasound as an imaging modality remains quite promising.

Tumor-like Mass Beside a Runner's Knee: Extruded Lateral Meniscal Cyst

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Case Description: A 62-yr-old male runner with a history of bilateral knee osteoarthritis and chronic knee pain presented for evaluation due to a left lateral knee mass. On presentation to our outpatient physiatric musculoskeletal office, the patient complained of left lateral knee pain, pressure and the recent development of a mass that was very clearly visible and palpable at the lateral aspect of his knee. X-rays and MRI were ordered to determine the etiology of his new lateral knee mass. X-rays revealed severe medial compartmental narrowing and tri-compartmental osteophytic lipping but no soft tissue masses were identified. MRI revealed a lateral meniscal tear with associated extrusion of the lateral meniscus through the lateral capsule, thus forming a lateral meniscal cyst (i.e., the mass that had been noted on physical exam). Aspiration of the cyst yielded 2 mL of very viscous fluid. Repeated aspiration of this cyst has yielded up to 10 mL of very viscous fluid, with the aspiration providing symptomatic relief of lateral knee pain and pressure, while improving function.

Conclusion/Discussion: Meniscal cysts are a relatively uncommon finding and a rare cause of knee pain or mass. They more commonly arise from the lateral meniscus and are frequently associated with meniscal tears. MRI is generally sufficient to diagnose a meniscal cyst if an associated meniscal tear is visualized. In the absence of a meniscal tear, tissue diagnosis may be necessary to rule out malignancy. Treatment options include needle aspiration vs. more definitive care via surgical excision. Meniscal cysts are a rare but possible source of knee pain and can even produce a focal mass. Musculoskeletal physicians should be aware of meniscal cysts and the appropriate diagnostic and treatment options.

Scapular Dyskinesis due to Subscapular Elastofibroma

James F. Wyss, MD, PT
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Case Description: A 62-yr-old female referred for physical therapy to our outpatient physical therapy center due to right anterior shoulder pain. On initial presentation, the patient reported insidious onset of right shoulder pain following an elective cholecystectomy two months prior. She was concerned that her condition was caused by poor positioning of her right upper limb during surgery. She was seen by her primary care physician (PCP), diagnosed with impingement syndrome and referred to physical therapy (PT). She demonstrated signs and symptoms consistent with impingement syndrome, including a painful arc of motion and subacromial tenderness but the most significant finding was excessive scapular elevation and protraction with elevation of the shoulder in the scapular plane. After responding poorly to five sessions of PT, including scapular stabilization exercises, her treatment plan was altered to include scapulothoracic joint mobilizations. While performing these mobilization techniques a large (5x5cm), soft round mass was palpated just medial to the medial border of the scapula, when the scapula was rotated upwardly to end range. She was referred back to her PCP and then to her surgeon. The mass was suspected to be a lipoma, but was confirmed to be a subscapular elastofibrolipoma after resection. Her shoulder pain and scapular dyskinesis resolved postoperatively and she was discharged from PT.

Conclusion/Discussion: Scapular dyskinesis is an alteration in the resting position or motion of the scapula during scapulo-humeral movements. Most commonly it is the result of muscular imbalances or abnormal activation patterns of the scapular stabilizing muscles. Here we present an unusual cause of scapular dyskinesis and although soft tissue masses are a very rare cause, physicians who practice musculoskeletal medicine should consider this entity in their differential diagnosis when evaluating a patient with scapular dyskinesis.